Indiannica Learning
Knowledge beyond horizons

SMARTBYTE

A Course in Computer Science

Book 7

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Series Editor
Abraham Tharakan

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Preface

Tell me and I forget. Teach me and I remember. Involve me and I learn.

— Benjamin Franklin

To enable children learn with ease, it's important to involve them and make learning enjoyable. It is often felt that children nowadays are tech-savvy (or rather gadget-savvy). But at the same time, we need to also ensure that they become familiar with the know-how of the technology. **SmartByte**, a new course in computer science designed for classes 1 to 8, lets them learn the concepts behind the technology and apply them. To make learning more engaging, it seamlessly integrates other subjects with computer science. It has a learner-centric practice-oriented approach and includes up-to-date developments.

The course emphasizes on the tools and their uses which will help learners explore, comprehend, and apply rather than the user-manual approach followed in most computer science books. It covers open-source software programs, such as Tux Paint, Scratch, Python, GIMP, and Synfig, to provide children ample scope to experiment with computer programs.

The salient features of the course are as follows:

- **Remember**—a simple fact that learners should remember
- **Quick Tip**—an alternative or short method to do an activity
- **Did You Know**—an additional piece of information related to a topic
- **Checkpoint**—in-text questions to assess the learner's understanding
- **Quick Learn**—a short activity linking a concept to its application
- **Key Terms**—end-of-chapter list of important terms
- **Project**—cross-curricular linked projects
- **Lab Activity**—provides learners with hands-on practice
- **Explore More**—gives learners opportunities to go beyond the textbook
- **Notes for the Teacher**—useful tips for the educator

The course is supplemented with comprehensive **teacher's manuals** with teaching aids to facilitate classroom transactions. Further, an easy-to-use **learning app** provides children support material and gives them instant access to learning and assessment resources.

I sincerely hope the course will help children assimilate the concepts with ease and make learning of computer science enjoyable.

—Bhavana Pandey

Key Features

A useful, simple fact that learners should remember

Remember

A program written in a programming language is called source code. The translated machine-language program is called object code.

Did You Know?

Describing an algorithm using an informal way that does not require any programming language syntax is called pseudocode.

An additional piece of information related to a topic

An alternative or short method to do an activity

Quick Learn

Open the Script mode and display your name using the print command. Also, save the program on your desktop.

A short activity linking a concept to its application

Quick Tip

If you want to draw straight lines with the Pencil (or any of several other paint tools), click at the starting point, then hold down the Shift key, and click at the ending point.

Checkpoint

Answer the following questions.

1. You are a programmer. Which language will you prefer to write a program?
2. What do you mean by 'machine code'?
3. What was the need for translator programs?
4. Programs written in low-level languages need no translators. Then why do we need high-level languages, which require translators?
5. Which language is more hardware dependent—assembly language or high-level language? Explain how.

In-text questions to assess learners' understanding

Key Terms

Data Sorting	Arrangement of the given data according to a particular field, either in ascending or descending order
Data Filtering	A quick and easy way to find and work with a subset of data that meets specific criteria
Custom Filtering	To apply multiple conditions to filter data
Conditional Formatting	Applying formatting based on the conditions given by the user

List of important terms

Application-based Questions

1. Neha has added a video clip to her presentation, and she wants to do the following tasks:
   i) Play the video continuously till she stops it on her own
   ii) Start the video automatically
   Help her in doing the tasks, and write the options she should use in each case.

Assignments to check the application of the concepts taught

Lab Activity

1. Create a presentation on global climate change. Collect data and add charts to show climate change in India over the past few years.
2. Create a presentation on the digestive system. Add animation and transition effects wherever possible. You can also add your recorded voice to the slide to explain the function of each part.

Enhances learning by doing

Project

1. Think about how computer languages evolved. Discuss in class.
2. You visited a bank with your uncle. He deposited some money in his account. Write an algorithm, and then draw a flow chart representing the steps followed. Write the input, processing, and output in these steps.
3. Write an algorithm to create the sieve of Eratosthenes.
   (The sieve of Eratosthenes is a method of finding prime and composite numbers from 1 to 100.)

Encourages application of concepts in real-life situations and links computer science with other subjects

Useful tips for the teacher

Notes for the Teacher

- Help students to try out the different ways to copy and move data.
- Demonstrate all the methods to select cells, rows, and columns.
- Discuss the use of the Flash Fill and Auto Fill features. Describe how these are useful in saving time and effort.
- Format the worksheet properly. Do not use too many formatting features.

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1 Number Systems

After going through this chapter, you will be able to—

- **represent** data in the binary number system;
- **explain** the need for learning different number systems;
- **convert** a number from one number system to another; and
- **perform** addition, subtraction, multiplication, and division on binary numbers.

Anurima is in her maths class. Her maths teacher is explaining the Indian and International place value charts to the class.

'Observe both the place value charts and compare them,' the teacher says.

Anurima observes the periods and place values in the two place value charts and draws the following comparison between the two:

Indian System of Numeration

- Ones is the first period, consisting of three places—ones, tens, and hundreds.
- Thousands is the second period, consisting of two places—thousands and ten thousands.
- Lakhs is the third period, consisting of two places—lakhs and ten lakhs.
- Crores is the fourth period, consisting of two places—crores and ten crores.

International System of Numeration

- Ones is the first period, consisting of three places—ones, tens, and hundreds.
- Thousands is the second period, consisting of three places—thousands, ten thousands, and hundred thousands.
- Millions is the third period, consisting of three places—one million, ten millions, and hundred millions.
- Billions is the fourth period, consisting of three places—one billion, ten billions, and hundred billions.

Anurima notices that the first period is the same in both the systems of numeration. She also learns that in the Indian system, the first comma comes after three digits from the right, that is, after the Ones period. But the subsequent commas come after every two digits. On the other hand, in the International system, we place a comma after every three digits starting from the right.

The maths class is over. Now it's the turn of the computer class. The computer teacher, Ms Latha, comes in the class. She tells the class that today they are going to learn about number systems.

'How are number systems related to computers, Ma'am?' Anurima wondered.

Ms Latha explains to the class that computers have their own number systems. She asks the class to recall the fact that computers understand only the binary language, which is based on the binary number system. She further explains that the binary number system uses only two digits—0 and 1, where 0 represents OFF and 1 represents ON state.

'We input a wide variety of data into a computer, such as decimal numbers, letters, graphics, and audio and video clips. However, all this data has to be converted into binary digits for the computer to work on it or store it,' Ms Latha clears the children's doubts further.

'What is the need for number systems in a computer, Ma'am?' Akash asks.

Ms Latha explains, 'Data is stored on a computer in long strings of 0s and 1s. It becomes confusing to read and interpret such long strings. It would be much easier if the same data is displayed in some other number systems, such as decimal, octal, and hexadecimal. So programmers should be familiar with different number systems.'

She then introduces the class to four common number systems used by computer programmers:

- Decimal number system
- Binary number system
- Octal number system
- Hexadecimal (hex) number system

Did You Know?

Each binary digit of a number is called a bit. The leftmost bit of a number is known as the most significant bit (MSB), and the rightmost bit is known as the least significant bit (LSB). A group of four bits is called a nibble, while a group of eight bits is known as a byte.

Decimal Number System

Ms Latha tells the class that the decimal number system is the most commonly used number system. It uses 10 digits from 0 to 9 and is also called the base-10 number system. She draws the decimal number system on the board.

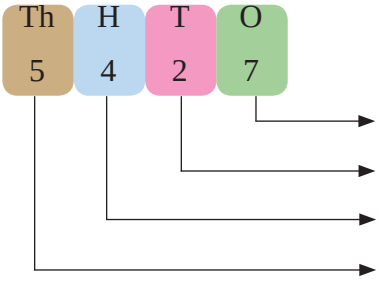
Ten thousands	Thousands	Hundreds	Tens	Ones
10^4	10^3	10^2	10^1	10^0

Each position in the decimal number system is represented by a power of 10.

The positional or place value of a digit in the decimal number system is found by multiplying the digit with the corresponding power of 10.

'Let us write the positional values of the digits in the number 5427,' Ms Latha tells the class.

She then calculates the positional values of the digits as follows:



Positional value

$7 \times 10^0 = 7 \times 1 = 7$

$2 \times 10^1 = 2 \times 10 = 20$

$4 \times 10^2 = 4 \times 100 = 400$

$5 \times 10^3 = 5 \times 1000 = 5000$

As the class is already familiar with the decimal system, which is the most common number system that we use in our daily lives, they do not find any difficulty in understanding it.

Binary Number System

Ms Latha now explains the binary number system to the class. She tells the class that in the binary number system, data is represented in 0s and 1s.

She tells the class that each position in the binary number system is represented by a power of 2. The positional value of a digit in a binary number is found by multiplying the digit with the corresponding power of 2. She then writes the positional values of the digits in the binary number $(1011011)_2$.

Remember

The decimal number system is called the base-10 number system, while the binary number system is called the base-2 number system.

Face values	1	0	1	1	0	1	1
Positional values	$1 \times 2^6 = 64$	$0 \times 2^5 = 0$	$1 \times 2^4 = 16$	$1 \times 2^3 = 8$	$0 \times 2^2 = 0$	$1 \times 2^1 = 2$	$1 \times 2^0 = 1$

Conversion from Binary to Decimal

Ms Latha now explains to the class the steps for converting a binary number into a decimal number.

Step 1: Find the positional values of all the digits of the given number.

Step 2: Add all the positional values.

Now the class is asked to convert the binary number $(1011011)_2$ done previously into a decimal number.

Anurima adds a third row 'Sum of positional values' and got the answer '91'.

Face values	1	0	1	1	0	1	1
Positional values	$1 \times 2^6 = 64$	$0 \times 2^5 = 0$	$1 \times 2^4 = 16$	$1 \times 2^3 = 8$	$0 \times 2^2 = 0$	$1 \times 2^1 = 2$	$1 \times 2^0 = 1$
Sum of positional values	$64 + 0 + 16 + 8 + 0 + 2 + 1 = 91$						

Thus, $(1011011)_2 = (91)_{10}$.

Conversion from Decimal to Binary

Next, Ms Latha elaborates the steps to convert a decimal number into a binary number.

Step 1: Divide the decimal number by 2.

Steps 2: Note down the remainder and divide the quotient again by 2.

Step 3: Keep on dividing the quotient obtained by 2, and note down the remainders until you get the final quotient as zero.

Step 4: Write all the remainders starting from the last remainder and moving upwards.

She then shows one example to the class.

Let us convert $(138)_{10}$ to its corresponding binary form.

Divisor	Quotient	Remainder
2	138	
2	69	0
2	34	1
2	17	0
2	8	1
2	4	0
2	2	0
2	1	0
	0	1

Thus, $(138)_{10} = (10001010)_2$.

Quick Learn

Find the decimal equivalents of the following binary numbers:

1. 111
2. 10101
3. 1110101

Did You Know?

A word consists of two or more bytes.

Quick Learn

Write the binary equivalents for the following decimal numbers:

1. 15 2. 19 3. 206 4. 349

Octal Number System

'Let me tell you about the octal number system,' Ms Latha says.

'First tell me what the word 'octo-' means,' she asks the class.

Akriti answers, 'Ma'am, "octo-" means eight, like octagon.'

'Great,' replies Ms Latha and tells the class, 'The octal number system has only eight digits from 0 to 7. So it is a base-8 number system.'

She then writes the positional values of the digits in the number $(31702)_8$ and coverts it into a decimal number.

Face values	3	1	7	0	2
Positional value	$3 \times 8^4 = 12288$	$1 \times 8^3 = 512$	$7 \times 8^2 = 448$	$0 \times 8^1 = 0$	$2 \times 8^0 = 2$
Sum of the positional values	$12288 + 512 + 448 + 2 = 13250$				

Thus, $(31702)_8 = (13250)_{10}$.

Converting a Decimal Number into an Octal Number

Ms Latha next converts the number $(128)_{10}$ into an octal number.

This time she divides the number by 8 and writes the quotient and remainders. She keeps on dividing the quotients by 8 until the final quotient is less than 8 and then writes the remainders in reverse order.

Divisor	Quotient	Remainder
8	128	
8	16	0
8	2	0
	0	2

Thus $(128)_{10} = (200)_8$.

Conversion from Binary to Octal

Ms Latha writes the binary equivalents for the eight octal digits on the board.

0	1	2	3	4	5	6	7
000	001	010	011	100	101	110	111

She asks the class to observe the table. She tells the class that to convert a number from binary to its octal equivalent, divide it into groups of three starting from the right bits and then find the octal number for each group of three digits. She makes it clear with an example.

$(001010110)_2$ = 001 010 110

1 2 6

Thus, $(001010110)_2 = (126)_8$.

Quick Learn

Calculate the decimal equivalent of the following octal numbers:

1. 25647 2. 89876 3. 65743

Conversion from Octal to Binary

'What will you do to find the binary equivalent of an octal number?' Ms Laths asks the class.

Ravinder has the answer, 'We will replace each octal digit with its binary equivalent.'

'Great,' Ms Latha says and asks the class to find the binary equivalent of the octal number $(261)_8$.

$(261)_8$ = 2 6 1

010 110 001

Therefore, $(261)_8 = (010110001)_2$.

Remember

A binary number system has a base 2, decimal has 10, octal has 8, and hexadecimal has 16.

Hexadecimal Number System

Before Ms Latha can explain the hexadecimal number system, the class is able to tell her that 'hexa' means 'six' and 'decimal' means 'ten'. Elated, Ms Latha explains that the hexadecimal number system has 16 digits: numbers from 0 to 9 and letters from A to F.

The children have understood that it has a base-16 number system. Ms Latha now tells the class that the letters A to F represent the numbers 10 to 15.

A	B	C	D	E	F
10	11	12	13	14	15

The class has now understood that to find the decimal equivalent of a number, we need to find the positional values of all the digits of the number and add them. In case of a hexadecimal number, we multiply the number with base 16. Ms Latha asks the class to find the decimal equivalent of $(D5CF)_{16}$. The class is able to find the answer, which is $(54735)_{10}$. But Ishan's answer is different. Akram, who sits beside him, is quick to help him work out the sum properly.

	D	5	C	F
Positional value	$13 \times 16^3 = 53248$	$5 \times 16^2 = 1280$	$12 \times 16^1 = 192$	$15 \times 16^0 = 15$
Sum of positional values	53248 + 1280 + 192 + 15 = 54735			

Therefore, $(D5CF)_{16} = (54735)_{10}$.

Conversion from Decimal to Hexadecimal

Ms Latha does not have to put in much effort in explaining to the class how to convert a number from decimal to hexadecimal. She asks Ashima to come forward and show how to convert $(156)_{10}$ into the hexadecimal number system.

Ashima does it with ease as given here.

Divisor	Quotient	Remainder
16	156	
16	9	C
	0	9

Therefore, $(156)_{10} = (9C)_{16}$.

Quick Tip

To convert an octal number or a hexadecimal number to a binary number, first convert the number to decimal and then to binary.

Checkpoint

1. Find the decimal equivalents of the following hexadecimal numbers.
   a) 65AFB
   b) 123ABC
   c) 799BDE
   d) 800CDE
2. Find the octal equivalents of the following binary numbers.
   a) 110011
   b) 0101
   c) 0011
   d) 100100

Computer Arithmetic

'Let us now learn about arithmetic operations,' Ms Latha tells the class in her next computer class.

'But we know about arithmetic operations—addition, subtraction, multiplication, and division,' tells Akram.

'Yes, in a computer, data is processed by the CPU using arithmetic operations. It is done by the arithmetic logic unit (ALU) of the CPU,' Ms Latha explains.

'But before that, the data is converted into binary code by the CPU. Do you know why?' she asks the class.

'Because a computer understands only binary code,' comes the reply from the class.

The class has understood that the CPU of a computer converts the data into binary and then perform arithmetic operations on it.

Ms Latha explains to the class the rules to perform arithmetic operations using the binary digits.

Binary Addition

Ms Latha then writes the rules followed by a computer for adding two binary digits on the whiteboard.

A	B	A + B
0	0	0 + 0 = 0
0	1	0 + 1 = 1
1	0	1 + 0 = 1
1	1	1 + 1 = 10

Ms Latha takes an example.

Example: 1100 + 1001

$$\begin{array}{rrrrr} & 1 & 1 & 0 & 0 \\ + & 1 & 0 & 0 & 1 \\ \hline 1 & 0 & 1 & 0 & 1 \end{array}$$

Thus, $(1100)_2 + (1001)_2 = (10101)_2$.

Binary Subtraction

Here are the rules for binary subtraction done by a computer.

A	B	A – B
0	0	0 - 0 = 0
0	1	0 - 1 = 1 with a borrow of 1
1	0	1 - 0 = 1
1	1	1 - 1 = 0

Ms Latha tells the class that when 1 is subtracted from 0, it is necessary to borrow 1 from the next higher order bit and that bit is reduced by 1.

She now asks the class to solve 1001 − 0011.

$$\begin{array}{rrrrr} & 1 & 0 & 0 & 1 \\ - & 0 & 0 & 1 & 1 \\ \hline & 0 & 1 & 1 & 0 \end{array}$$

Therefore, $(1001)_2 – (0011)_2 = (0110)_2$.

Binary Multiplication

‘Can you write the rules for multiplying two binary digits?’ asks Ms Latha to the class.

The class has understood that the arithmetic operations on binary digits are performed the same way as on decimal numbers. Ishan comes forward and writes the technique of multiplying two binary digits.

A	B	A × B
0	0	0
0	1	0
1	0	0
1	1	1

Akram comes forward and solves the sum 1001 × 101.

$$\begin{array}{r} 1\ 0\ 0\ 1 \\ \times\ 1\ 0\ 1 \\ \hline 1\ 0\ 0\ 1 \\ 0\ 0\ 0\ 0\ \times \\ +\ 1\ 0\ 0\ 1\ \times\ \ \times \\ \hline 1\ 0\ 1\ 1\ 0\ \ 1 \end{array}$$

Therefore, $(1001)_2 \times (1001)_2 = (101101)_2$.

Quick Learn

Perform the following operations:

1. 1111 + 0011
2. 1111 ÷ 101
3. 0011 × 0011
4. 1111 – 0011

Binary Division

'The binary division is also similar to that of decimal numbers,' Ms Latha tells the class and shows it with an example.

Divide 1100 by 100.

$$\begin{array}{r} 11 \\ 100\ \overline{)\ 1100} \\ -100 \\ \hline 0100 \\ -\ 100 \\ \hline 00 \end{array}$$

Therefore, $(1100)_2 \div (100)_2 = (11)_2$.

Ms Latha's class is happy to learn about the different number systems. They have gained an understanding that we need to convert large binary numbers into octal or hexadecimal numbers to make it easier for us to write these.

Key Terms

Binary number system	A number system that uses only two digits, 0 and 1, for representing numbers
Decimal number system	A number system that has numbers to the base of 10 and uses digits from 0 to 9 for representing numbers
Octal number system	A number system that uses the base of 8 to represent numbers
Hexadecimal number system	A number system that represents numbers to the base of 16

Recap

- A computer presents all data and information in the form of numbers.
- Some common number systems are the binary number system, decimal number system, octal number system, and hexadecimal (hex) number system.
- In a binary number system, every number is represented by a combination of 0 and 1 and the base of the binary number system is 2.
- In the decimal number system, there are ten numbers—0 to 9.
- The octal number system has eight digits from 0 to 7. The base of the octal number system is 8.
- A hexadecimal number system has 16 alphanumeric values from 0 to 9 and A to F. Every number is represented as 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F in this number system.
- We can easily convert numbers from one number system to another.
- The computer also performs addition, subtraction, multiplication, and division on the binary numbers.

Exercise

A. State *true* or *false*.

1. The ON state is represented by the binary digit 1.
2. The base of the octal number is 16.
3. The digit 14 is represented as B in the hexadecimal number system.
4. The octal number system represents digits from 0 to 7.
5. The binary number 0111 is equal to the decimal number 8.
6. In binary multiplication, 1 × 1 is 10.

B. Fill in the blanks.

1. A computer understands the _____ language.
2. Each binary digit of a number is called a _____.
3. The decimal number system represents digits from _____ to _____.
4. Each position in the binary number system is represented by a power of _____.
5. The base of the hexadecimal number system is _____.
6. In binary addition, 1 + 0 is _____.

C. Answer the following questions.

1. Explain the binary number system.
2. Convert the decimal number 155 to its hexadecimal equivalent.
3. Write the steps to change the decimal number system to octal number system with an example.
4. Convert the octal number 3122 to its binary equivalent.
5. Differentiate between octal and decimal number systems.
6. Convert the following numbers to decimal number systems:
   a) Octal number: 277
   b) Hexadecimal number: 32ABC
   c) Binary number: 11001100

Application-based Questions

1. How can you determine whether a number is decimal, octal, or hexadecimal?
2. Rohan's computer teacher has asked him to add the following binary numbers. Also, the output must be converted to the decimal number system. Help him in doing the task.
   a) 1111 and 1000 b) 100100 and 1100
3. Samaria wants to convert the decimal number 110011 to hexadecimal number. Help her in completing the task.
4. How will you convert the following hexadecimal numbers to binary numbers?
   a) A1B b) 30

Lab Activity

1. Create a PowerPoint presentation on 'How to convert one number system to another'. Make use of different features of PowerPoint and run your presentation in the class.
2. Make a flowchart on the following:
   a) Converting decimal number system to binary number system
   b) Converting hexadecimal number system to decimal number system
3. Perform the following operations:
   a) Divide the binary number 111111 by 101.
   b) Find out the difference between the binary numbers 1001 and 100.

Project

1. Compare decimal subtraction with binary subtraction. Make a Word document by illustrating different examples.
2. Write an algorithm to convert a number from one number system to decimal and decimal number system to another number system. You can work in pairs.

Explore More

- Who invented the binary number system?
- Why is binary number system used in computers?
- Why is decimal system the most commonly used in daily life?
- What is ASCII code?

Work Wisely

Learning about various number systems will help you build a strong foundation in both maths and computers.

Weblinks

- https://www.electronics-tutorials.ws/binary/bin_2.html
- https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_number_system_conversion.htm

Notes for the Teacher

- Explain the importance of the different number systems.
- Give enough examples to make students learn the conversion from one number system to another.

2 Cybersafety

After going through this chapter, you will be able to—

- **spread** awareness about cybersafety concerns;
- **practice** and promote positive online behaviour; and
- **list** the ways to tackle cybersecurity concerns.

The world is witnessing a digital revolution, driven by technological advancements. Today, information technology dictates the way we communicate, do business, entertain ourselves, study, and even conduct research. In fact, information technology has transformed every aspect of our life.

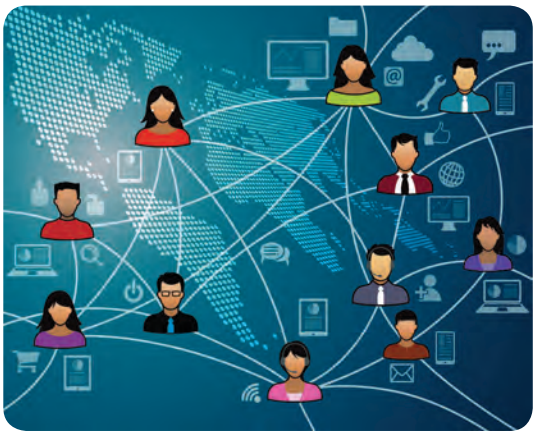


Fig. 2.1 Cyberworld

The driving force behind this change is the internet. The internet, as we know, is a global network of interconnected computers and other devices. It has created a virtual world of interconnected machines and humans, called **cyberworld** or **cyberspace**. The cyberworld is a human-made world without any physical boundaries and it is a dynamic world that is constantly evolving.

This cyberworld has always fascinated Sunil. He studies in class 7 in a school in Meerut. He likes to explore the World Wide Web for information on various topics. Be it information related to the life cycle of a silk moth, major water bodies of the world, health benefits of almonds and walnuts, stories of the famous writer Ruskin Bond, or how to play the guitar—the content is there on his computer screen on the click of a mouse. This certainly is helping Sunil enrich his knowledge.

During summer vacations, Sunil comes to Delhi to visit his uncle. His uncle, Mr Ravikant Sharma, is a software engineer. Mr Sharma observes that Sunil has a habit of surfing the internet quite often.

Cybercrimes

Observing Sunil's constant need to get connected to the cyberworld, his uncle decides to make him aware of the risks associated with using the internet.

‘Every good thing has a flip side, so does the internet,’ he says to Sunil.

‘Some people take advantage of the anonymous nature of cyberspace to misuse it,’ he further tells Sunil.

Sunil is intrigued by what his uncle is saying and wants to know how cyberspace is misused.

He further explains to him that some people indulge in unlawful activities aimed at stealing sensitive information or harming other computers and networks. Such unlawful activities in the cyberspace are called **cybercrimes,** and the people who indulge in cybercrimes are called **cybercriminals**.

He mentions frauds, identity theft, data theft, plagiarism, and violation of privacy as some of the cybercrimes.

‘Let me tell you about these in detail,’ he tells Sunil.

He further explains to Sunil that cybercriminals can intrude into our computer systems and steal sensitive data, such as passwords, credit card numbers, bank account details, and any other information that may be of use to them. He then explains some activities that cybercriminals indulge in.

Hacking

Mr Sharma tells Sunil a story to explain hacking:

‘In September of 2016, almost 500 million user accounts of Yahoo were compromised. This was a breach of personal data from a major technology company ever. Yahoo later disclosed that their website was hacked in 2014, which they came to know only in 2016. This worsened the situation as users got really agitated after learning that some people had access to all their accounts for two long years. This is known as hacking, which is one of the major fraudulent practices in cyberspace.’

‘**Hacking** is an act of gaining unauthorized access into a computer or a computer network,’ Mr Sharma tells Sunil.

‘Yes, I have heard the word “hacker” from my computer teacher,’ Sunil exclaims.

‘A hacker is a person who gains unauthorized access to someone else’s computer system,’ says Mr Sharma.

Mr Sharma also adds that even though hackers are a security threat, some organizations employ the services of hackers to identify loopholes in their systems. This helps the organizations to take corrective measures to make their data and systems secure. Law enforcing agencies use the services of hackers to track activities of cybercriminals and prevent cybercrime.

‘We call such hackers ethical hackers,’ Mr Sharma tells Sunil.

Denial-of-Service (DoS) Attack

A denial-of-service (DoS) is a cyber attack in which the attacker makes a computer or a network unavailable to its user by disrupting the services of the user’s internet connection.

In the most common type of DoS attack, the attacker overloads the server with requests. The server is unable to process such a large number of requests. As a result, genuine users are not able to access the services. Mafiaboy, Operation Ababil, and Mirai IoT botnet are some examples of denial-of-service attacks.

Spam

The term **spam** refers to unsolicited bulk emails, which can be either commercial (such as advertisements) or non-commercial (such as jokes or chain letters). The internet is flooded with multiple copies of the same message in an attempt to force the message on people who would not otherwise choose to receive it.

Spam in itself is not harmful and most spam contains commercial advertisements. However, these are often aimed at trapping people in dubious get-rich-quick schemes.

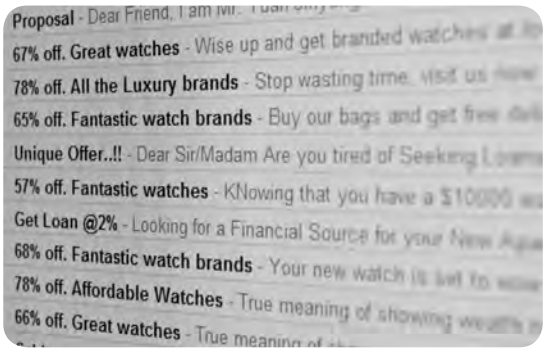

Proposal - Dear Friend, I am Mr.
67% off. Great watches - Wise up and get branded watches at
78% off. All the Luxury brands - Stop wasting time. visit us
65% off. Fantastic watch brands - Buy our bags and get free
Unique Offer..!! - Dear Sir/Madam Are you tired of Seeking
57% off. Fantastic watches - KNowing that you have a $10000
Get Loan @2% - Looking for a Financial Source for your New
68% off. Fantastic watch brands - Your new watch is set to
78% off. Affordable Watches - True meaning of showing
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Fig. 2.2 Spam emails

Identity Theft

Identity theft is a major problem in the growing world of cyberspace. Identity theft occurs when someone's personal information, such as name, date of birth, bank account details, and credit card details, is stolen for the purpose of committing a fraud.

A cyber thief may use the stolen identity to get a new credit card in the victim's name. They can then make online transactions or purchases using the credit card. The victims of cyber theft have huge debts in their names without even knowing about it.

Some of the ways in which identity theft can happen include:

- browsing the web using unsafe connections,
- disclosing personal details in chat rooms,
- opening unsolicited emails,
- shopping on insecure or fake websites,
- using insecure passwords, and
- phishing.

Fig. 2.3 Identity theft emails

Phishing

Mr Sharma shares a story with Sunil:

'In 2013, an American journalist's Twitter account was compromised. There was a tweet from his account that said that there would be an explosion in the White house. This led to the stock markets plunging and the whole world felt the effects of the email security breach. This was later found to be an email theft, a routine email scam that led the journalist to give up some secured information. An email that looked like one from a trusted sender was sent to the journalist. The email had a link to login and update information. The journalist opened the link and while updating the information, the scammer was stealing his passwords and other information.

On the same day, another person received an email from a brand that he had ordered a package from. There was a little pop-up window that he saw in the email, and he clicked on it. Little did he know that the pop-up window in the email was actually a fraud and that once opened, it would steal all the information of the person.'

Mr Sharma explains to Sunil that such emails are known as phishing emails and they appear legitimate but are actually scams to steal users' identity.

Phishing is an act of sending deceptive email messages aimed at gaining sensitive information from unsuspecting people. Such emails appear to be coming from reliable sources. They direct the people to fake websites that mimic the websites of their bank or credit card provider. The victims are then asked to verify or update the confidential information. This information is then used to cheat them or to commit identity theft.

Cyberbullying and Cyberstalking

Cyberbullying is an act of harassing a minor using the internet or mobile phones. It can take place through text messages, emails, or social media posts. Examples of cyberbullying include sending upsetting messages, sending threatening emails, posting mean comments, and uploading embarrassing photos of someone. Cyberbullying among adults is referred to as cyberstalking.

Cyberstalking is the use of the internet to harass, stalk, or threaten someone. Cyberstalkers obtain personal information of the victims and keep an eye on their online activities. They often harass the victim by sending objectionable or threatening messages. Cyberstalking is a criminal offence.

If you ever face such a situation while being online, immediately bring it to the notice of your elders or parents.

Sunil is now aware about the kinds of safety concerns associated with the internet. He asks his uncle how such threats can be prevented.

Reporting cybercrimes

Mr Sharma tells Sunil that cybercrimes can be reported to the following agencies:

- **Local Law Enforcement Agency:** It includes the police department. The police department has its own cybercrime investigation cell that can investigate the matter depending on the severity of the crime.
- **Indian Computer Emergency Report Team (CERT-In):** CERT-In has been formed to serve as a national agency to perform various functions in the field of cybersecurity.

Viruses

'Have you heard about viruses in computers?' Mr Sharma asks Sunil.

'Yes uncle, our computer teacher often talks about it,' he replies.

Mr Sharma then explains that virus is a kind of malware. He further explains that **malware** is a malicious software program designed to harm a computer system, gain unauthorized access to a computer system, or gather sensitive information. 'Worms and Trojans are other kinds of viruses,' he tells Sunil.

Mr Sharma tells Sunil that a **computer virus** is a malicious software program that replicates itself.

Fig. 2.4 Laptop attacked by a virus

‘How does it replicate itself?’ asks Sunil.

‘The virus replicates by making copies of itself. It attaches itself to a program or a file and activates whenever the infected file is opened or run. It then replicates itself rapidly and infects other files on the computer, causing greater damage,’ answers Mr Sharma.

Sunil wants to know how a virus affects our computers. Mr Sharma tells him that it can modify programs, delete files, or format hard disks.

‘Computer viruses are often spread through email attachments, file downloads, and infected portable devices,’ he explains further and mentions, Melissa and Anna Kournikova as some examples of computer viruses.

Types of Computer Viruses

Mr Sharma next tells Sunil that viruses are categorized by their infection targets.

Program virus

The program virus infects program files that commonly have extensions such as .com, .exe, .sys, .ovl, and .scr. Examples of such viruses are Acid Rain Trojan and Amoeba.

Boot virus

The boot virus affects the storage area of the computer where the files required to boot a system are stored. The area that contains all the start-up files is called a boot sector. Examples of boot viruses are Michelangelo and Azusa.

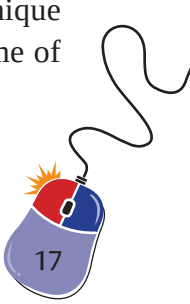
Macro virus

The macro virus infects data files. They spread rapidly as infected documents are shared across networks. The famous Melissa virus is an example of macro virus.

Antivirus

An antivirus is a software program that protects your computer from computer viruses. The first antivirus program was designed specially to combat computer viruses. Most modern antivirus software, however, can protect your computer against a wide range of malware.

An antivirus program uses several methods to identify a virus. Signature-based detection is a common method. In this method, when the antivirus program scans a file for viruses, it checks the contents of the file against a dictionary of known viruses. If a virus signature is found in the file, the antivirus program removes the virus. The program usually performs one or more of the following actions: quarantine, repair, or delete. Quarantine isolates a file and makes it inaccessible. It is usually the first action an antivirus software program will take if it finds a malicious file. Encrypting the file is a good quarantine technique because it renders the file useless. Symantec, McAfee, Kaspersky, Avira, AVG, and F-secure are some of the well-known antivirus solutions.



Mr Sharma continues. A computer without an antivirus installed is highly vulnerable to cyberattacks.

He emphasizes on the following points:

- An antivirus is a computer program that is designed to detect and destroy computer viruses and other malware.
- To protect computers or networks from virus attacks, we need to install antivirus software programs in them.
- The antivirus needs to be updated regularly to deal with new viruses being created.

Fig. 2.5 Using antivirus

Virus-removal Tools

Mr Sharma further adds that there are some virus-removal tools that are used for removing specific viruses from infected computers. Unlike complete antivirus scanners, they are the programs usually not intended to detect and remove an extensive list of viruses. However, they are designed to remove specific viruses more effectively than normal antivirus software. Examples of virus-removal tools are McAfee Stinger and Microsoft Windows Malicious Software Removal tool. These tools can sometimes do a better job of removing a specific virus than conventional antivirus software.

Tips to Avoid Viruses

Mr Sharma shares some tips to minimize virus risks to a computer with Sunil.

- Have automatic protection turned on all the time. Automatic protection is already set for you when you install most antivirus software using the preset options.
- Perform a weekly manual scan of your hard disk. Manual scans are an added protection and they help to ensure that your computer is virus free. Most antivirus programs have these automatic scans scheduled during installation.
- Scan all CDs or pen drives before using them for the first time.
- Update your antivirus programs regularly.
- Regularly back up your hard disk.
- Buy legal copies of all software applications you use and make write-protected backups.

Some other Malicious Software Programs

Mr Sharma then tells Sunil about two other malicious software program—worms and Trojans.

Worms

A **worm** is a malicious software program that is designed in such a way that it copies itself from one computer to another, independently. Unlike a computer virus, a worm can copy itself without any human intervention. For example, an email worm can send copies of itself to all email addresses in the email contact list of the infected computer. A network worm makes copies of itself through a network.

Worms replicate themselves very quickly and in great number. They clog networks and cause delays in opening web pages or web services. Sasser, Code Red, Blaster, and Conficker are some examples of computer worms.

Trojans

A **Trojan horse** is a malicious program that is disguised as a useful program. A Trojan might damage the hard disk of the infected computer. Some Trojans create a backdoor, allowing a remote access to the victim's system. This enables cybercriminals to spy on the user, steal sensitive data, or disrupt the system.

Unlike viruses and worms, Trojans do not replicate themselves. However, they can spread through email attachments, chat software, and address book of the infected system. CryptoLocker, Flashback, and Vundo are some examples of Trojans.

Checkpoint

Match the following.

a) Virus	i) CryptoLocker
b) Worm	ii) Mafiaboy
c) Trojan horse	iii) Get-rich-quick scheme
d) Denial-of-service attack	iv) Code Red
e) Spam	v) Melissa

Cybersafety

Mr Sharma then explains to Sunil that we should use the cyberspace in a safe and responsible manner.

'This is called cybersafety,' he says to Sunil.

'First and foremost, we should be aware of the online risks and take appropriate actions to protect ourselves while being online,' explains Mr Sharma. He then lists some cybersafety guidelines.

Remember

Never share your personal information and passwords.

- Be cautious not to click on unknown links or ambiguous URLs.
- Download only trusted applications from reputable sources.
- Set a strong password that has a combination of numbers, letters, and special characters. Avoid using personal information or common words in your passwords.
- Do not share your passwords with anyone. Keep changing the passwords regularly.
- Make personal information secure, and put adequate access restrictions on it.

- Limit the information you share online. Do not post sensitive information such as your address, family details, or your whereabouts.
- Do not share your personal information or organizational data with anyone over the phone, while chatting, or online.
- If someone known to you posts information about you, make sure it is not something you are uncomfortable sharing with strangers.
- If you suspect any data or security breaches, immediately report to the concerned authorities.
- Verify information before posting it online. Do not post misleading or false information.
- Try to avoid accessing secure sites, which require a password or personal information, on public computers like in an internet café. If required, use the 'anonymous' mode on the browser as the browser then does not keep track of the sites you visit. Make sure you log out and close the browser when you are done.
- Check the URL of the site you are visiting. If it is supposed to be a secure site, the URL will start with 'https' rather than 'http', and there will be a lock symbol displayed.

'By diligently following these guidelines, we can minimize the risks and stay safe in cyberspace,' Mr Sharma tells Sunil.

Cybersecurity

Sunil has now understood that cybersafety is all about using the cyberspace in a safe and responsible manner. Mr Sharma now tells him that we should also take due care to secure our computers, networks, and data to protect them from unauthorized access, malware attack, data theft, and disruption of services.

He then discusses some cybersecurity measures to tackle the growing menace of cybercrimes.

Did You Know?

The Government of India launched Information Security Education and Awareness (ISEA) project to boost cybersecurity through seminars and workshops.

Identity Protection

Mr Sharma emphasizes that while working on the internet, we must not post personal information on sites in the public domain.

'This may lead to loss of your personal information, and one can misuse it to scam you,' he cautions Sunil.

'I make online transactions and provide my personal details only on secure and trusted e-commerce sites. I never share any personal information on public domain sites,' he adds.

Passwords

Sunil is aware of what passwords are. His family in Meerut had set a password for their computer at home.

'Why do we use passwords?' Mr Sharma asks Sunil.

'So that no one else can use our computer,' Sunil replies.

‘Great! Only you and your family members can use your computer. We use passwords to secure data and information. But how do you set a password?’ he asks Sunil.

Fig. 2.6 Protecting systems using passwords

He then tells Sunil that the password we create must be strong enough not to be easily cracked. He gives Sunil some tips to create a password and secure it.

- Always create a password with at least eight characters.
- The password should have a combination of upper-case letters, lower-case letters, numbers, and symbols. Some sites have different rules for creating passwords. Make sure you read the guidelines.
- Never use your name, date of birth, personal information, or common words as your password.
- Avoid using the same password for different accounts.
- Keep changing your passwords at regular intervals.
- Do not let web browsers remember your passwords, especially when browsing using a public connection.
- Never share your password with anyone.

‘This is something new for me. I will now take care to use a strong password for my computer,’ Sunil assures his uncle.

Mr Sharma next explains two more ways of cybersecurity.

Firewall

Mr Sharma tells Sunil that a **firewall** is a network security system. He lists the features of a firewall:

- A firewall is used to prevent unauthorized access to a private network connected to the internet.
- A firewall can be a software program, a hardware, or a combination of both.
- The firewall examines all incoming information. It then blocks the information that does not meet the specified security criteria.

Privacy and confidentiality of information

Mr Sharma next tells Sunil that protecting sensitive information is called **privacy**.

'There is a need to control privacy settings on social media accounts,' he tells Sunil and emphasizes the following points:

- Read all the terms and conditions under privacy settings. Avoid accepting them blindly.
- Connect with only the people you know and trust.
- Before going offline, log out of accounts, sites, and systems that you have used.
- Confidential or private data must be kept secured.
- Sharing of personal information over the internet must be avoided.

Fig. 2.7 Firewall

Checkpoint

Answer the following questions.

1. Write any three methods you can use to protect data from unauthorized access.
2. How can cybercrime be prevented?
3. Suggest some rules to protect your data from unauthorized access.
4. What is the role of passwords in cybersecurity?

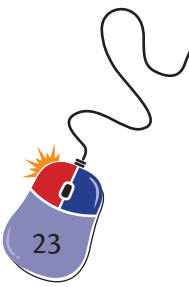
Key Terms

Cyberbullying	The act of harassing a minor using the internet or mobile phones
Cybercrimes	Unlawful activities in cyberspace
Cyberspace	A virtual world of interconnected machines and humans
Cyberstalking	The use of the internet to harass, stalk, or threaten someone
Hacker	A person who engages in gaining unauthorized access to someone else's computer system
Hacking	The act of gaining unauthorized access into a computer or network
Malware	A malicious software program written to gain unauthorized access to a computer system or gather sensitive information
Phishing	An act of sending deceptive email messages and gaining sensitive information from people

Spam	Unsolicited bulk emails, which can be either commercial or non-commercial
Trojan horse	A malicious program that is disguised as a useful program
Virus	A malicious software program that replicates itself and infects other files on the computer system
Worm	A malicious software program that copies itself from one computer to another without any human intervention

Recap

- The internet is a global network of interconnected computers and other devices.
- Cybercriminals can intrude into systems and steal sensitive data such as passwords, credit card numbers, bank account details, and any other information that may be of use to them.
- Some malicious software programs are written to harm computer systems.
- The harmful software can steal information and gain unauthorized access to a computer system.
- A denial-of-service (DoS) attack involves causing disruption in the services of a host connected to the internet.
- When someone's personal information, such as name, date of birth, bank account details, and credit card details, is stolen for the purpose of committing a fraud, it leads to identity theft.
- Users should follow cybersafety guidelines to promote positive online behaviour.
- Some security measures should be taken to secure computers, networks, and data.
- The users can protect their identity while working online by using passwords, using firewall, and installing antivirus.
- One must report the cybercrime to the concerned law enforcement agency.



Exercise

A. Choose the correct options.

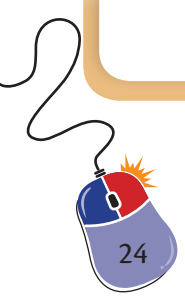
1. A malicious software program that is disguised as a useful program is called
   a) worm. b) antivirus. c) malware. d) Trojan.
2. Which of the following is not malware?
   a) Mellissa b) McAfee c) Vundo d) Code Red
3. The bombardment of unwanted or junk mails is called _____.
   a) phishing b) virus attack c) spam d) denial-of-service attack
4. An antivirus is a software program that _____.
   a) corrupts files on a computer system
   b) hackers use to gain unauthorized access to another computer
   c) protects a computer from computer viruses and other malware
   d) prevents users from accessing data on a private network
5. Which of the following is not an antivirus?
   a) McAfee b) CryptoLocker c) F-secure d) Norton Internet Security
6. Which of the following statements is correct?
   a) You should keep your passwords short.
   b) You should keep the same password for all your accounts.
   c) You should use more than one password wherever possible.
   d) You should share your passwords with your friends.

B. State *true* or *false*.

1. Cybercriminals can intrude into our computer systems and steal sensitive data.
2. Hackers are not at all helpful for us.
3. Conficker is a computer virus.
4. The term 'spam' refers to unsolicited bulk emails.
5. Phishing is an act of sending deceptive emails.

C. Fill in the blanks.

1. A _____ is a malicious software program that replicates itself rapidly when activated and causes harm to the infected computer or data.
2. An _____ is a computer program that detects and destroys computer viruses and other malware.
3. A _____ is a software program or a piece of hardware that helps prevent unauthorized access to a private network connected to the internet.
4. A _____ is a person who gains unauthorized access to another person's computer system.
5. _____ is a software program that copies itself from one computer to another without any human action.



D. Answer the following questions.

1. What is an antivirus?
2. Explain the term ‘phishing’.
3. What is a firewall?
4. List out some cybersafety measures that help promote a positive and safe online behaviour among users.
5. Where do you report a cybercrime?
6. How can you secure your system from unauthorized access?
7. How does a computer virus spread from one system to another?

Application-based Questions

1. One of your friends used public Wi-Fi on his tablet. Are there any risks involved? Give reasons for your answer.
2. What security measures can be taken to secure cloud services?
3. What do you understand by biometrics authentication? How do they work? Are they safe?

Lab Activity

1. Create a presentation on ‘Cyberbullying and cybercrimes’. Use animations and transition effects to enhance the presentation.
2. Create a Word file and enter information on the following:
   a) What would you do if you get to know someone who is being cyberbullied?
   b) From where can you get support if you are being cyberbullied?

Project

Find out and list down what security measures are taken by the e-commerce websites.

Work Wisely

If you find your computer giving pop-up advertisements randomly while you are working on your computer, inform your teacher or elders. Never click on such advertisements.

Weblinks

- http://www.isea.gov.in/isea/home/index.html
- www.infosecawareness.in

Notes for the Teacher

- Emphasize using cyberspace in a safe and responsible manner.
- Make students well aware of the online risks, and advise them to take the help of elders in protecting themselves while being online.

3 More on GIMP

After going through this chapter, you will be able to—

- **insert** images in GIMP and
- **use** various Transform and Paint tools to enhance an image.

This summer vacation, Akash visits his maternal uncle's home in Lucknow. His maternal uncle, Mr Prakash Raj, is a wild life photographer.

Mr Raj had recently visited Bandipur National Park located in the Chamarajanagar district in Karnataka. He tells Akash that the Park provides shelter and habitat to tigers, elephants, spotted deer, antelopes, and many other animals. He shows Akash various photographs that he has captured in the Park.

Mr Raj then begins transferring the photographs to his computer through a USB cable.

'What will you do with these photos now?' Akash asks his uncle.

Mr Raj answers, 'I will send these to various wildlife magazines. They will publish my photographs. People write about wildlife and the need for its preservation in these magazines.'

'But right now, I need to send this photo of an elephant to the *National Wildlife Magazine*,' he tells Akash.

All the photos are now transferred to the computer.

'Let me work on this photo,' Mr Raj says while opening the photo of the elephant.

'Can't you send them directly to magazines?' asks Akash.

Mr Raj explains to him that sometimes he needs to modify the photos clicked by him to improve their quality.

'I will work on this photo using GIMP,' he tells Akash.

Akash learnt about GIMP in his previous class. His computer teacher told the class that GIMP is a type of image manipulation software. 'Hey, I know about GIMP,' exclaimed Akash. Mr Raj replies, 'Then I'm sure you know that GIMP is an acronym of GNU Image Manipulation Program. It is an open-source software program, which can be freely downloaded from the internet. It can be used for tasks such as editing and retouching an image, converting an image from one format to another, and drawing free-form images. We can add images to GIMP and use the Selection tools and some of the Paint tools.'

'I just know a little bit. Can you teach me more about GIMP?' Akash requests his uncle.

Mr Raj replies, 'Sure! Let me show you how to use Transform and some Paint tools.'

Transform Tools

Mr Raj opens an image using GIMP. Akash is curious to know what his uncle going to do with the photo.

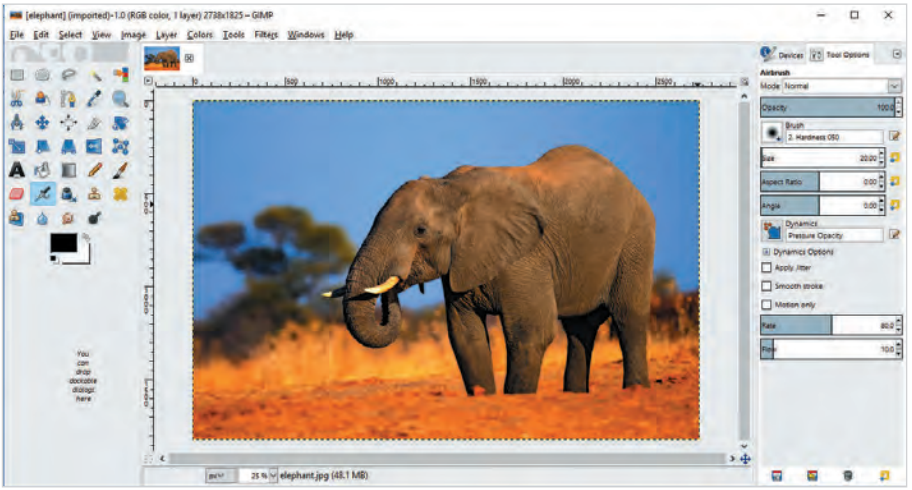


Fig. 3.1 Image added to GIMP

Mr Raj then tells Akash that GIMP provides us with various Transform tools.

'What does transform mean?' asks Akash.

'When we transform something, we make it better by changing its appearance,' Mr Raj replies.

He then tells Akash that in GIMP, the Transform tools are used to move, rotate, scale, and crop images.

Mr Raj continues, 'You can also work on multiple images or layers in GIMP to make a composite image.'

He further explains to Akash, 'Imagine different photos stacked on top of each other. Then think of these photos together making up a single image.'

'In image editing, we often work on layers. Splitting an image into layers is called layering,' Mr Raj continues.

Quick Tip

After selecting the Move tool, press and hold the Space bar key to move the canvas permanently.

'This is so interesting. I want to learn more,' Akash pleads to his uncle.

Elated by Akash's enthusiasm, Mr Raj offers to show him how the different Transform tools are used.

Move Tool (M)

Mr Raj selects the Move tool from the toolbox and drags the canvas to another position. He tells Akash that the Move tool is used to move image layers or selections. You can also move the text layer using this tool.

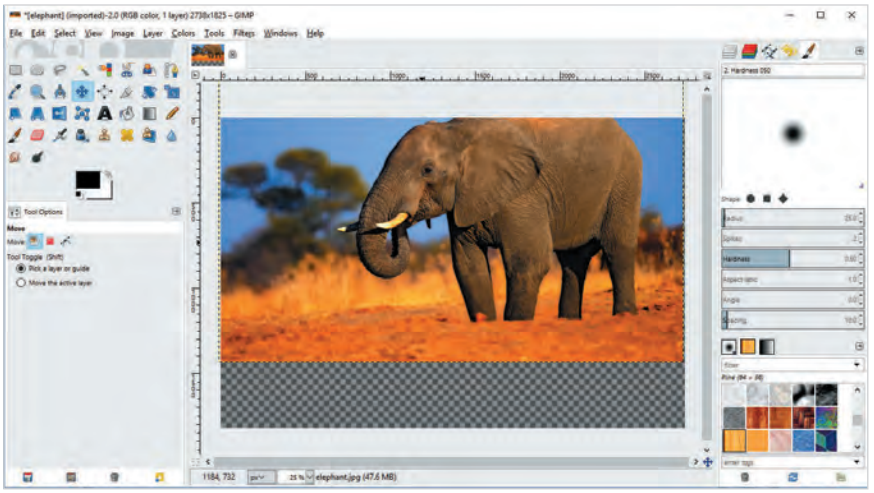


Fig. 3.2 Using the Move tool

Tool options

Mr Raj then shows the three buttons available under the Move option.

Layer: This is used to move only the current layer.

Selection: This is used to move the selection. Instead of mouse, you can also use Ctrl + Alt keys to move the selection.

Path: When a mouse goes over a path, it changes to a small hand. A path is created using the Path tool. You can move this path by selecting and dragging it.

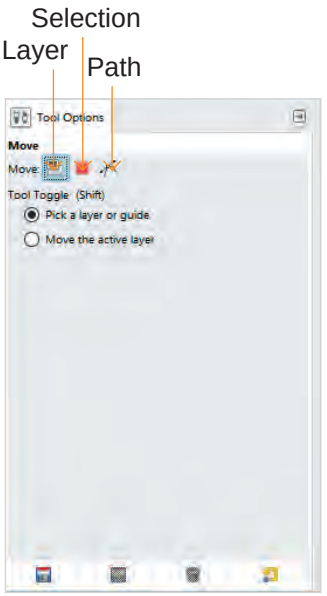


Fig. 3.3 Tool options

Crop Tool (Shift + C)

Mr Raj then moves on to the next tool—the Crop tool. It is used to remove unwanted portions from an image. He then selects the Crop tool from the toolbox and drags the mouse over the area he wants to keep. To validate the crop command, he presses the Enter key. The image of the elephant is cropped. The Undo command can always be used if you make a mistake.

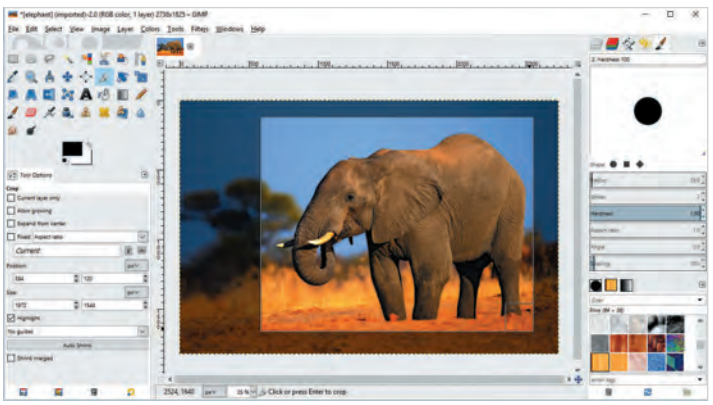


Fig. 3.4 Using the Crop tool

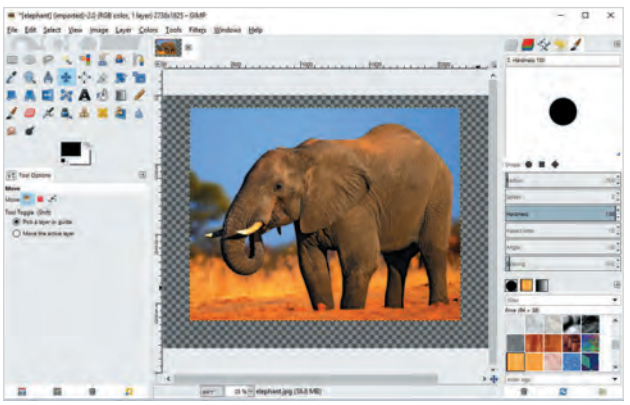


Fig. 3.5 Cropped image

Tool options

‘Here are the tool options,’ Mr Raj tells Akash showing him the tool options of the Crop tool.

Current layer only: This option affects only the current layer.

Allow growing: This option allows you to expand selection outside the canvas or the image layer.

Expand from center: This option selects the first pixel you click on taking from the centre and expands it.

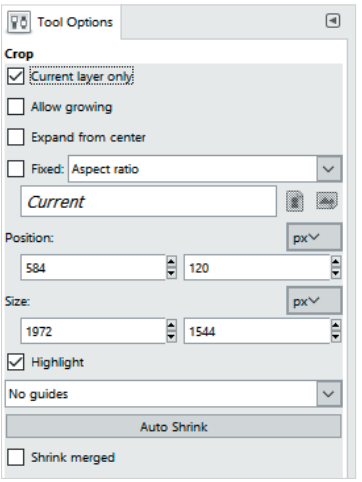


Fig. 3.6 Crop tool options

Rotate Tool (Shift + R)

‘As is clear by the name, the Rotate tool is used to spin an image or a part of it in different directions,’ Mr Raj tells Akash, ‘You can rotate an image in any direction by dragging it to the desired angle.’ He then rotates the image of the elephant. He emphasizes that the Rotate tool rotates an image without distorting its pixels.

Mr Raj has a question for Akash now: ‘Do you know what a pixel is?’

Akash answers, ‘Pixels are small elements that make up an image. Pixel is a short form of picture element.’

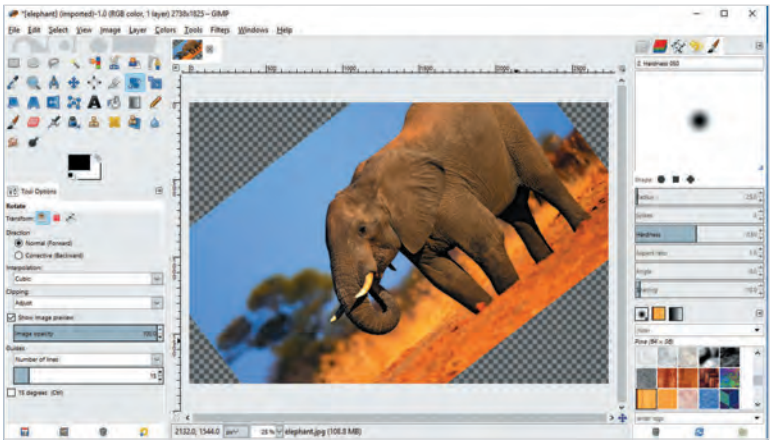


Fig. 3.7 Using the Rotate tool

Did You Know?

You can open and edit Photoshop (.psd) files in GIMP.

Scale Tool (Shift + T)

Next, Mr Raj shows the Scale tool. He uses this Scale tool to set the height and width of the image as given below.

- He selects the **Scale** tool from the toolbox. He then drags the mouse pointer over the image.
- The **Scale** dialogue box opens on the screen.

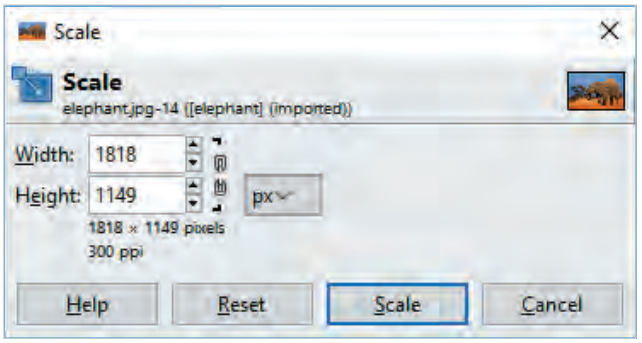


Fig. 3.8 Scale dialogue box

Quick Tip

You can undo or redo your actions using Ctrl + Z and Ctrl + Y keyboard shortcuts respectively.

- He enters the desired values in the width and height boxes manually. When he is done, he clicks on the **Scale** button to see the results.

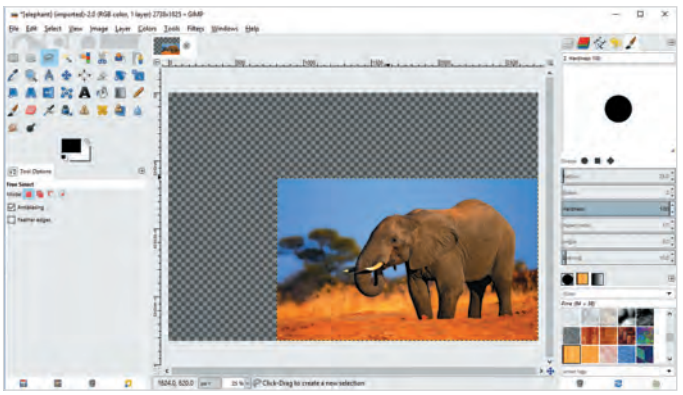


Fig. 3.9 Scaled/resized image

Quick Learn

Add an image to GIMP. Scale the image and move it to the top-right corner of the canvas window.

Shear Tool (Shift + S)

Mr Raj now asks Akash to select the Shear tool from the toolbox and drag the mouse pointer over the image either horizontally or vertically. Akash drags the mouse pointer horizontally, and this is how the image looks now.

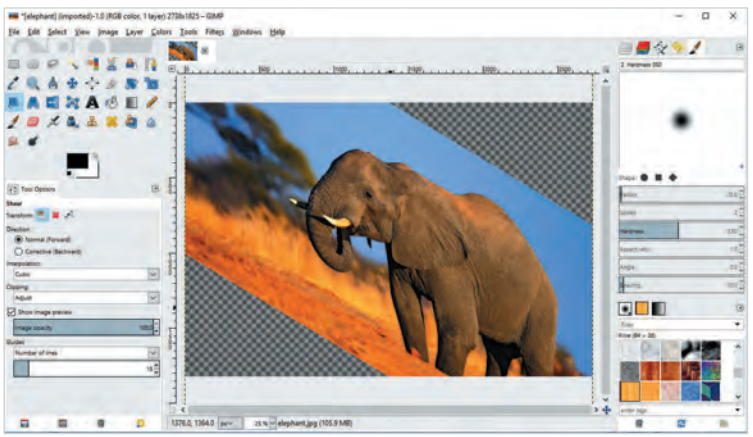


Fig. 3.10 Using the Shear tool

Remember

The Shear tool distorts the pixels of an image, while the Rotate tool does not distort the pixels.

Mr Raj tells Akash that the Shear tool is used to move one part of a layer, selection, or path in one direction and the other part in the opposite direction. He also tells Akash that this tool can only move the image and cannot rotate it.

Perspective Tool (Shift + P)

Akash now wants to know what the Perspective tool does to an image. Mr Raj tells him that the Perspective tool is used to change the dimensions of layers or selections.

After selecting the perspective tool from the toolbox, Akash drags the mouse pointer over the image. He sees a grid of small squares appearing on the image and the Perspective dialogue box opening. Mr Raj asks him to drag the mouse pointer in the direction in which he wants to transform the image. Akash drags the mouse pointer to the right and clicks on the **Transform** button.

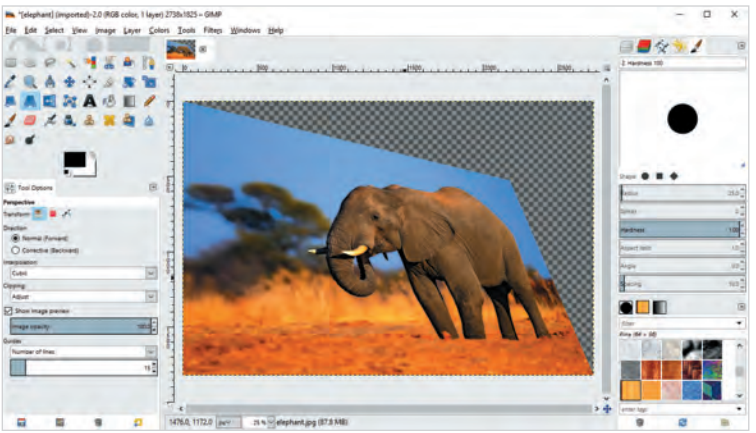


Fig. 3.11 Using the Perspective tool

Flip Tool (Shift + F)

Akash asks his uncle, ‘Can you flip an image upside down?’ Mr Raj replies, ‘Yes, of course. You can use the Flip tool for that.’ ‘Here! Try and flip the elephant image’, he offers to Akash. Akash uses the Flip tool and turns over the image horizontally.

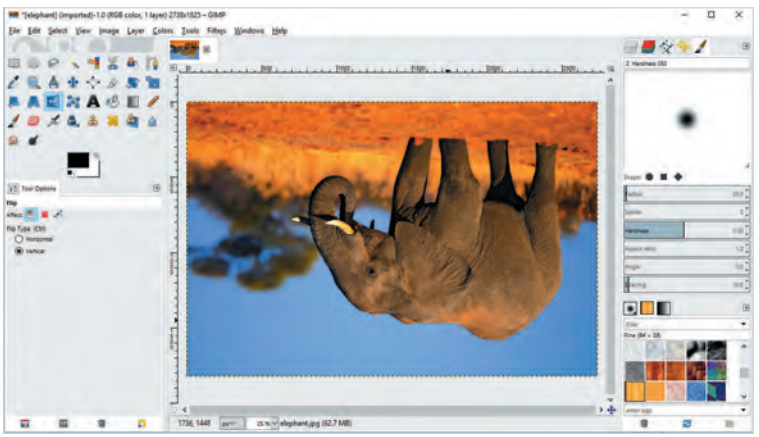


Fig. 3.12 Using the Flip tool

Cage Transform Tool (Shift + G)

Next, Mr Raj wants Akash to practise using the Cage Transform tool. This time he opens the image of a car on GIMP.

He tells Akash that the Cage Transform tool is used to deform a selection.

This time Akash needs help. Mr Raj selects the tool and then selects the area he wants to transform. He then sets anchor points by the freehand drawing that is around the area and presses the Enter key to confirm the transformation.

Akash has understood that after creating a cage or selection, we need to drag the anchor point from where we want to distort the image.

Fig. 3.13 Original image

Fig. 3.14 Image after using the Cage Transform tool

Checkpoint

Complete the table by writing the functions of the given tools.

S. No.	Tool	Function
1.		
2.		
3.		
4.		
5.		

Some More Paint Tools

Quite excited on learning GIMP, the next day, Akash learns about Paint tools in GIMP. Mr Raj tells him that Paint tools let us draw and modify images added to GIMP. He then opens the photo of the elephant in GIMP and shows Akash the Paint tools available in GIMP.

Clone Tool (C)

'What does clone mean, Akash?' Mr Raj asks Akash.

'It means to make an exact copy of something,' Akash answers.

'The Clone tool in GIMP also copies pixels from an image or pattern,' Mr Raj says.

Mr Raj selects the Clone tool and presses and holds the Ctrl key. He then clicks on an area of the image that he wants to duplicate. He then releases the Ctrl key and moves the mouse pointer over the area where he wishes to create the clone.

Mr Raj tells Akash that if we use the Clone tool on a pattern, the pattern can be repeated side by side. He also adds that 'cloning' helps us improve an image by painting over them with the pixel from other areas.

The Brush size option in the Clone tool options window lets you increase or decrease the size of the brush, which affects the clone area.

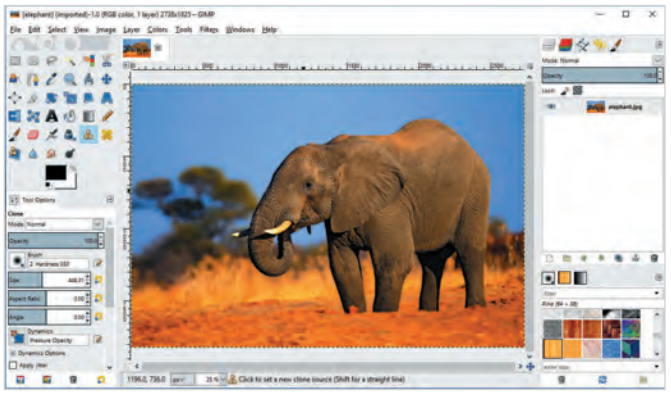


Fig. 3.15 Original image

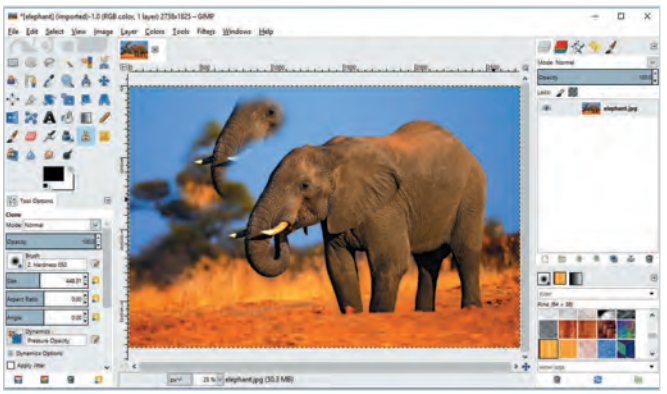


Fig. 3.16 Image after using the Clone Tool

Healing Tool (H)

Before using the Healing tool, Mr Raj asks Akash what 'healing' means. Akash loves to learn new words, and he has this word in his vocabulary.

'It means to become healthy again,' Akash answers.

'Great, let me show you how you heal an image in GIMP,' tells Mr Raj.

He then explains why the Healing tool is required,

'Sometimes, we have dark spots, blemishes, and wrinkles in an image. The Healing tool allows us to remove these imperfections from the image.'

To make it clearer, he adds some small black spots on the image of the elephant. He now selects the Healing tool and then presses and holds the Ctrl key. He hides the dark spots after clicking on them repeatedly.

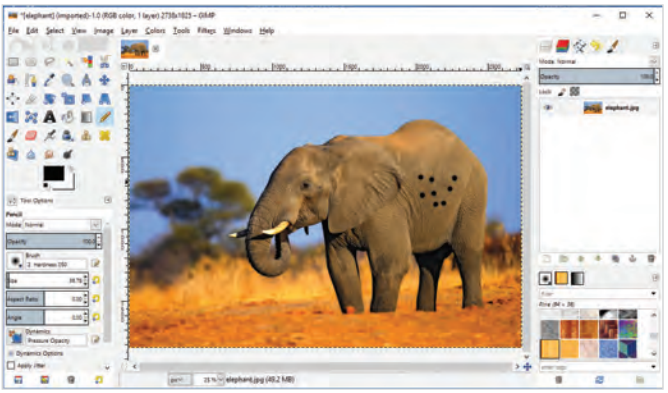


Fig. 3.17 Original image with dark spots

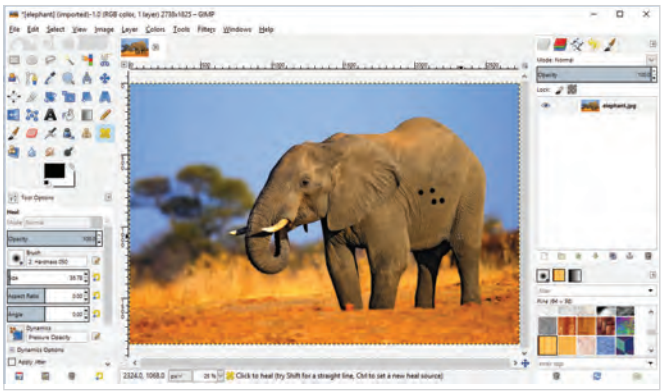


Fig. 3.18 Image after using the Heal tool

Blur/Sharpen Tool (Shift + U)

Mr Raj now asks Akash to use the Blur and Sharpen tools. The Blur tool creates a haze over the image and blurs it.

Mr Raj tells Akash that the Blur tool makes a pixel blend with neighbouring pixels, which increases the similarity of the pixels, and that is why you get the blur effect.

Fig. 3.19 Original image

Fig. 3.20 Image after using the Blur Tool

Now Akash uses the Sharpen tool and gets the result as shown here.

Fig. 3.21 Original image

Fig. 3.22 Image after using the Sharpen Tool

Mr Raj explains how the Sharpen tool works:

'The Sharpen tool is used to increase the contrast of the pixels. It makes each pixel stand out from its neighbouring pixels. However, overuse of the tool increases the brightness too much.'

Tool options

Mr Raj shows two options that are available under the Blur and Sharpen tools.

1. **Convolve Type:** This option lets you switch between the Burn and Sharp tools. (The Burn tool darkens the colours of an image.)
2. **Rate:** This slider is used to set the strength of the blur and the sharpen effect.

Remember

The 'contrast' is the differences in colour or in light and dark. It is used in a photograph or painting to create a special effect.

Quick Tip

To toggle between the blur and sharp tool, hold down the Ctrl key and left-click the mouse.

Smudge Tool (S)

'Tell me a synonym of smudge that also begins with "s", Akash?' asks Mr Raj, who was sure that Akash knows the meaning of the word.

'Smear', comes the quick reply, 'meaning to make a dirty mark if you are talking about its verb form.'

'I am amazed at your vocabulary,' says Mr Raj, 'As you know the meaning of the word, you can easily tell me what the Smudge tool can do here.'

Akash says that it should be used to put colour on an image. Mr Raj explains that with the Smudge tool, first we need to select a colour and mix it with the neighbouring colours. He further tells Akash that holding down the Shift key produces the smudge effect in a straight line.

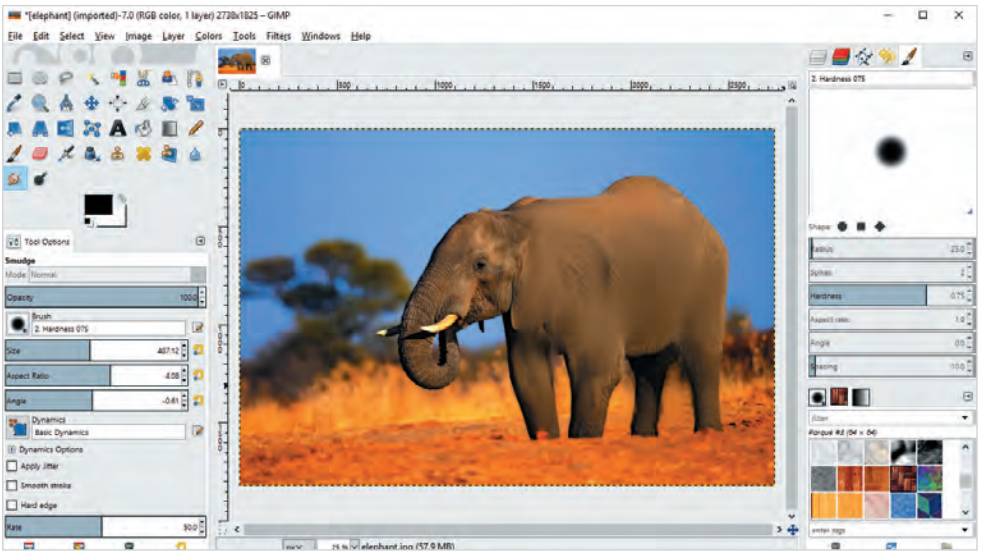


Fig. 3.23 Using the Smudge tool

Dodge/Burn (Shift + D)

This time Akash added a new word to his kitty, which is 'dodge'. Akash tells his uncle that 'dodge' means 'to avoid something.' Mr Raj is impressed and tells Akash that in context with GIMP, dodge has another meaning. He now tells him that the Dodge tool uses the current brush to lighten the colours of an image, while the Burn tool is used to darken the colours of an image.

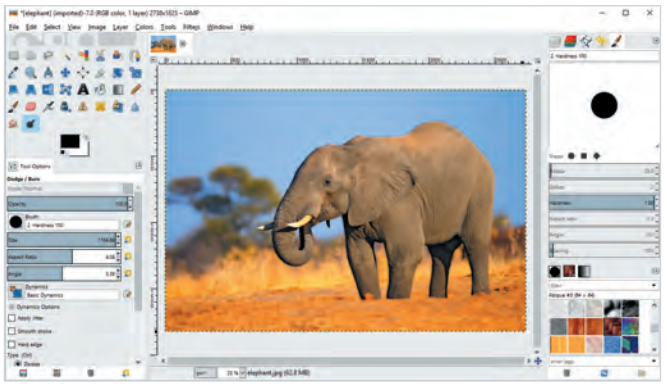


Fig. 3.24 Using the Dodge tool

Fig. 3.25 Using the Burn tool

Text Tool (T)

Next, Akash asks, 'Can we add text in an image using GIMP?'.

Mr Raj introduces him to the Text tool. He explains that it allows us to enter text directly on the canvas. But if you do not want to enter the text directly, you can select the **Use editor** option in the **Tool options** dialogue box.

Mr Raj asks Akash to select the Text tool from the toolbox and click on the canvas. A text toolbar appears. Mr Raj explains to Akash that it allows us to add and edit text in different ways. We can also select the text, right-click on it, and use the cut, copy, paste, and delete commands. As soon as you type the text, it appears in a rectangular frame on the canvas.

Fig. 3.26 Using the Text tool

Quick Tip

To toggle between the Dodge and Burn tools, hold down the Ctrl key and left-click the mouse.

Quick Learn

How can you add multiple text boxes to GIMP?

Tool Options

Mr Raj shows the tool options of the Text tool to Akash. As Akash is familiar with MS Word, he can use these efficiently in GIMP as well. Akash navigates these options and finds them easy to use.

Key Terms

Transform	To change the form of an object
Scale	To change the size
Perspective	A way of representing three-dimensional objects on a two-dimensional surface
Dodge	Exposing an area less than the rest during processing

Recap

- Transform tools are used to move, rotate, scale, and crop images.
- The Move tool is used to move an image or a selection.
- The Crop tool is used to remove unwanted areas from an image.
- The Scale tool is used to resize an image.
- The Perspective tool is used to change the dimensions of the layers or selections in an image.
- The Shear tool is used to move one part of a layer content, selection, or path to a direction and the other part to its opposite direction.
- The Flip tool is used to turn over an image.
- The Rotate tool is used to spin an image, selection, or path.
- Paint tools are used to draw and modify images.
- The Clone tool is used to copy pixels from an image or a pattern.
- The Healing tool is used to remove dark spots and wrinkles.
- The Blur tool is used to make a pixel blend with the neighbouring pixels.
- The Sharpen tool is used to increase the contrast of an image.
- The Smudge tool is used to smudge colours.
- The Dodge tool is used to lighten the colours of an image.
- The Burn tool is used to darken the colours of an image.
- The Text tool is used to add text to an image.

Exercise

A. Choose the correct options.

1. Which of the following tools is not a Transform tool?
   a) Move b) Crop c) Shear d) Blend
2. Which of the following tools is used to mix various colours?
   a) Smudge b) Perspective c) Dodge d) Burn
3. What is the keyboard shortcut to use the Scale tool?
   a) Shift + T b) Shift + S c) Shift + R d) Shift + P
4. Which tool is used to darken an image in GIMP?
   a) Smudge b) Move c) Dark d) Burn
5. Which tool helps to add text to an image?
   a) Move b) Text c) Shear d) Perspective

B. State *true* or *false*.

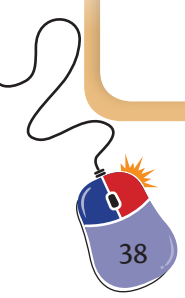
1. The keyboard shortcut to use the blur tool is Shift + U.
2. The Shift key is used to produce a smudge effect in a straight line.
3. The Shear tool distorts the pixels of an image.
4. The Flip tool flips an image only horizontally.
5. The Move tool is used to move the image layer or selection.

C. Fill in the blanks.

1. The _____ tool is used to crop an image.
2. The _____ key is used to toggle between the Blur and the Sharp tool.
3. The _____ tool is used to lighten the colours of an image.
4. The _____ tool is used to change the dimensions of the content of an active layer.
5. The _____ tool is used to move a selection.

D. Answer the following questions.

1. What is the use of the Move tool?
2. How can you crop an image?
3. What is the use of the Healing tool?
4. What is the difference between the Blur and Sharpen tools?
5. How is rotating an image different from flipping an image?



Application-based Questions

1. Rahul added a picture to GIMP. But he wants to use its mirror image. How can he do that?
2. Which tool will you suggest Riddhima to use for reducing the size of the cartoon character that she added to GIMP?
3. Neha created a poster on 'Respiratory system'. She added a paragraph and an image. Help her in doing the following tasks:
   a) Centre-align the heading.
   b) Change the font type to Segoe.
   c) Change the font colour to green.
   d) Indent the first line of the paragraph.
   e) Place the image at the centre of the canvas.

Lab Activity

1. Neha opened a picture on GIMP. She noticed that the picture is very dark. How can she lighten the picture?
2. Open GIMP and perform the following tasks:
   a) Open a new file with the width 1024 and height 768 pixels.
   b) Create a gradient background.
   c) Add your picture and crop it.
   d) Input text with the desired colour and font.
   e) Save the file.

Project

1. Design a birthday card for your friend using the appropriate tools.
2. Design a poster on 'Monuments in India'.

Explore More

- How can you adjust the brightness and contrast of an image?
- How are the Cage Transform and Perspective tools useful while working on an image?

Weblinks

- https://www.gimp.org/tutorials/
- https://howtogimp.com/help/help-with-gimp/gimp-tutorials/

Notes for the Teacher

- Discuss the drawing and transform tools to edit images.
- Demonstrate the use of each tool.
- Discuss the keyboard shortcuts for the tools.

4 Creating Charts in Excel

After going through this chapter, you will be able to—

- **describe** the components of a chart;
- **list** and **make use of** the different types of charts; and
- **create** and **format** charts and sparklines.

Lakshmi's mother is a maths teacher in a college. She has listed out the percentages of marks scored by students in semester 1 and semester 2 in a spreadsheet.

	A	B	C
1	Percentage Obtained by Students		
2	Name	Semester 1 (in %)	Semester 2 (in %)
3	Ankit	78	98
4	Nidhi	87	87
5	Ananya	78	67
6	Anshul	76	98
7	Medha	56	67
8	Sunil	57	65
9	Kirti	90	45
10	Kanika	87	90

Fig. 4.1 Percentages of marks obtained by students

Did You Know?

When you edit or update data in Excel, the chart created for that data updates automatically.

Lakshmi is observing her mother working on the Excel sheet curiously. She is familiar with Excel, but after a while, she notices a bar graph appearing on the screen.

'Hey, did you just make a bar graph based on the table?' Lakshmi inquires.

'Yes, do you know what a bar graph is?' asks her mother.

Lakshmi has the answer, 'A bar graph is a way of representing data in the form of columns or bars. I learnt it in maths.'

'What are the other ways of representing data?' her mother wants to test her understanding of data handling.

'Line graph, histogram, and pie chart are some of the other ways of representing data,' answers Lakshmi. She skips mentioning pictograph as she thinks it is too simple.

‘We can create represent data using various data-representation techniques in Excel.’ Lakshmi’s mother tells her, ‘and we call them charts,’ she adds.

‘Wow! You have to teach me everything, Mom’ Lakshmi exclaims.

Lakshmi’s mother is happy to oblige. She reiterates, ‘In Excel, we can represent data using various charts.’

Creating a Chart

Lakshmi’s mother opens a worksheet and says, ‘Let us create our data first, say, the expenditure incurred on various stationery items by six students of class 7.’ She then enters data in the worksheet.

Fig. 4.2 Charts group

‘Okay! We are ready to go,’ she adds as she gets ready to make a chart. ‘Let me show you the steps to represent our data in a column chart,’ she tells Lakshmi.

1. Select the data and click on the **Insert** tab.
2. Locate the **Charts** group and click on the **Insert Column or Bar Chart** option.
3. From the drop-down list that opens, click on the **Clustered Column** option under the **2-D column** category.

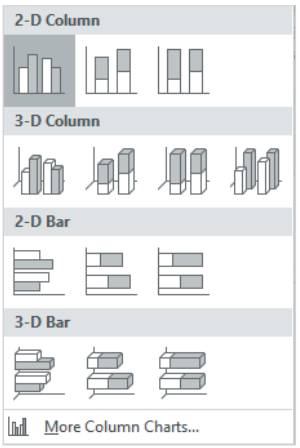


Fig. 4.3 Clustered Column option

Quick Tip

- The keyboard shortcut to insert a 2-D column chart is Alt+N+C.
- To quickly create a chart, select the data set and press the F11 function key. It will then create a chart—in a new Sheet tab named Chart1.

The column chart appears at the centre of the worksheet.

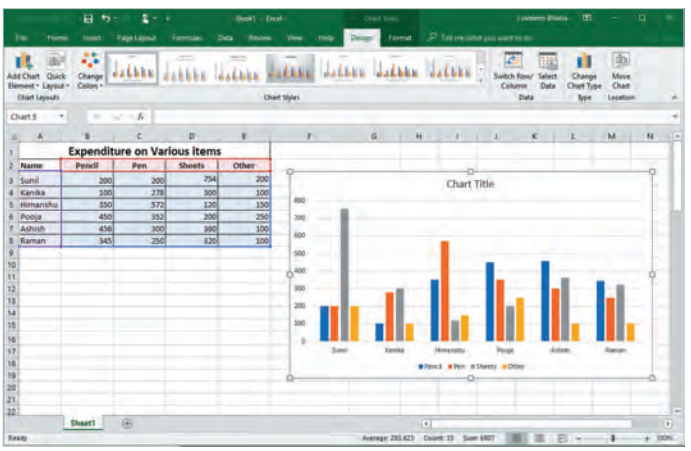


Fig. 4.4 Creating Column chart

Lakshmi's mother tells her that she can resize the chart by dragging the handles (circles) present on the sides of the Chart Area and can also move the chart by dragging the Chart Area.

'I am filling in the details of the chart elements. A chart has various elements. Let me show you,' says Lakshmi's mother.

'I have created a column chart. Use column chart when you want to show comparisons among items or changes in data over a period of time,' Lakshmi's mother tells her.

Lakshmi observes the column chart carefully. She notices that data is represented by vertical columns. Also, categories are organized horizontally and values are organized vertically.

Lakshmi notices that her mother has filled in various details on the chart. Her mother tells her that we need to fill in details of the chart elements from the table and enters the corresponding data in the chart respectively. She also adds that one can always modify any data both from the table and the chart directly.

The column chart is ready now. Lakshmi's mother shows her all the elements of the chart.

Adding Chart Components

Lakshmi's mother begins with the different components of a chart.

'Go to the **Add Chart Elements** on the **Design** tab,' Lakshmi's mother tells her and guides her through the various chart elements.

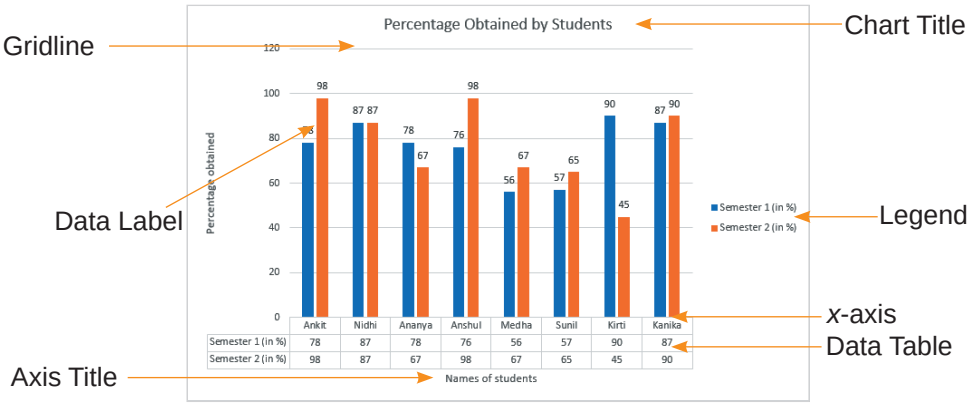


Fig. 4.5 Components of a chart

Axis title

Lakshmi finds two options in the Axis Titles menu:

- Primary Horizontal—displays titles along the *x*-axis
- Primary Vertical—displays titles along the *y*-axis

With guidance from her mother, Lakshmi selects **Primary Horizontal** option. A title box appears on the *x*-axis. She double-clicks on the text box and types 'Names of students'.

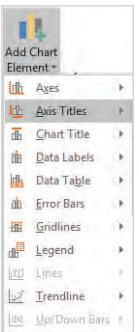


Fig. 4.6 Add Chart Elements command

Chart title

Lakshmi finds three options here:

- **None**—no chart title
- **Above Chart**—displays the title on the top of the chart
- **Centered Overlay**—displays the title in the centre of the chart area

She selects the **Above Chart** option and adds 'Percentage Obtained by Students' as the chart title.

Data labels

Lakshmi's mother tells her that the **Data Labels** option is used to display the value of each column. She asks Lakshmi to select any option; she selects the **Outside End** option.

Data tables

'Use this if you want to display the table of data for which the chart is created,' Lakshmi's mother tells her about the **Data Tables** option. Lakshmi selects the **With Legend Keys** option.

Gridlines

Lakshmi selects the **Primary Major Horizontal** option and she finds horizontal gridlines on the chart. Her mother tells her that major gridlines are shown at larger intervals, whereas minor gridlines are shown at smaller intervals.

Legend

Lakshmi selects the **Right** option. She now finds the Legend to the right of the chart.

Lakshmi is happy as the chart is now ready with all its components.

Lakshmi summarizes what she has understood about various chart components.

Chart Area is the area in which the chart and all its components are displayed. It is surrounded by a border.

Plot Area is the area of the chart in which data is plotted.

The *x*-axis is the horizontal axis of the chart. It is also known as the category axis.

The *y*-axis is the vertical axis of the chart. It is also known as the value axis.

Chart Title is the title given to a chart.

Axis Title is the title given to an axis. For example, 'Names of students' is an axis title.

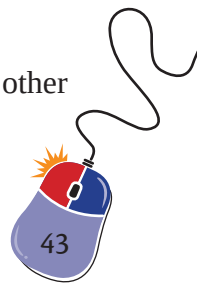
Data Table contains the set of data values from which a chart is created.

Legend contains symbols, colours, or patterns that uniquely identify and distinguish between the data series.

Data Label show the details of a data series or the data points.

Gridlines are the horizontal or vertical lines that extend from the axes and run across the plot area.

Quite clear with various components of a chart and column chart, Lakshmi now wants to learn about other types of charts.



Types of Charts

'Let me change the chart type now and show you other types of charts,' Lakshmi's mother tells her. She follows these steps to change the chart type.

1. She selects the chart and clicks on the **Change Chart Type** in the **Type** group. It opens the **Change Chart Type** dialogue box.
2. She now asks Lakshmi to click on the **All Charts** tab and select the type of chart she wants to use.
3. Click on the **OK** button. The selected chart will appear.

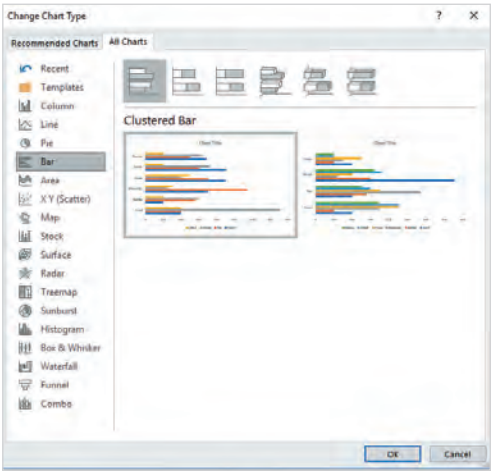


Fig. 4.7 Change Chart Type dialogue box

Line Chart

Laksmi's mother shows her a Line chart. She tells Lakshmi that a Line chart is best for showing trends in data. The data points are connected with lines that easily depict whether the values are increasing or decreasing.

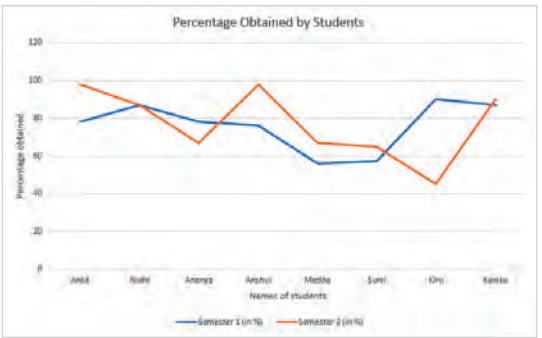


Fig. 4.8 Line chart

Pie Chart

Lakshmi's mother explains that a Pie chart, as you already know, displays data in the form of a circle that is divided into slices. Each slice of the circle or pie represents a proportion of the whole. In a Pie chart, various components of data are expressed as a portion of 360°.

Pie charts represent only one type of data series. The Pie chart created by Laksmi displays only semester 1 results.

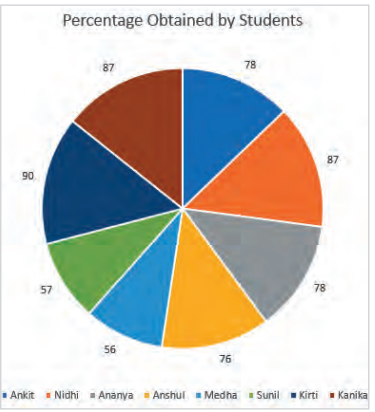


Fig. 4.9 Pie chart

Bar Chart

Next, Lakshmi creates a Bar chart. She notices that there are rectangular bars plotted horizontally. Her mother explains, 'As you can see, a Bar chart is similar to a Column chart except that it is plotted sideways. '

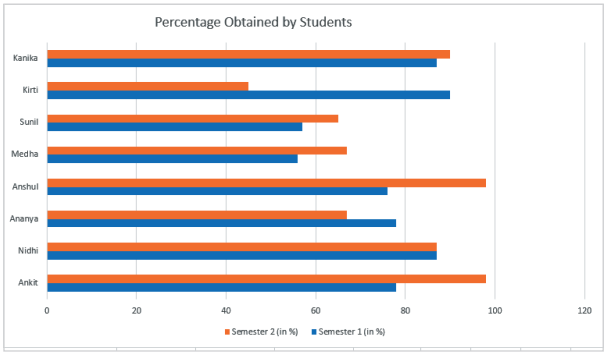


Fig. 4.10 Bar chart

Area Chart

Lakshmi's mother tells her that an Area chart is similar to a Line chart except that the area below the lines is filled in with colours.

Scatter Chart

Lakshmi finds that the Scatter chart is filled with dots of different colours. Her mother tells her that a Scatter chart is used to compare at least two sets of values or pairs of data and shows a relationship among the sets of values.

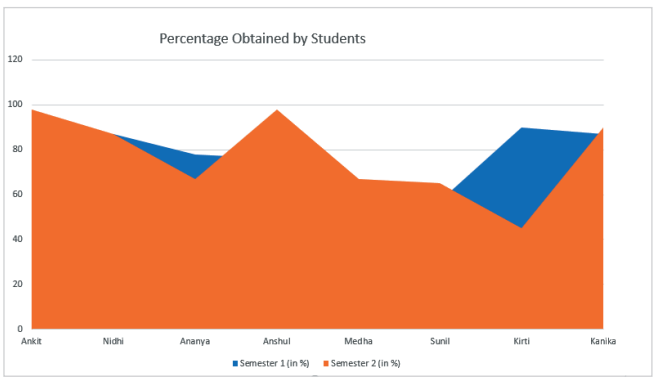


Fig. 4.11 Area chart

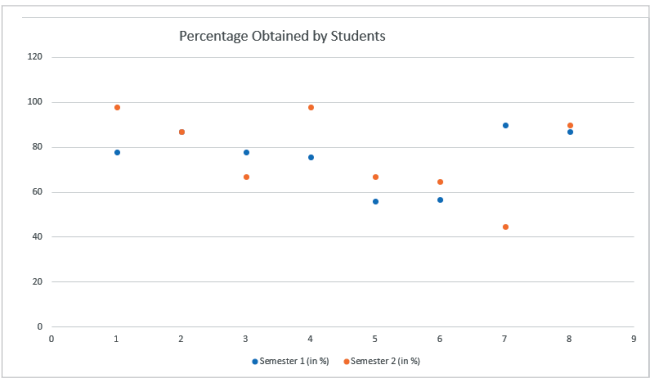


Fig. 4.12 Scatter chart

Combo

Lakshmi notices that the Combo chart is a combination of Column and Line charts.

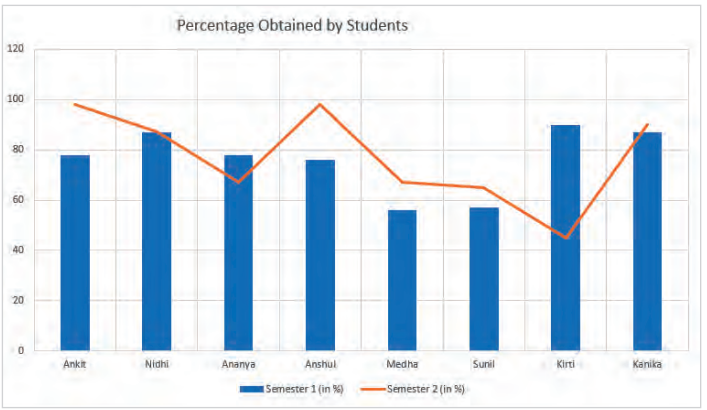


Fig. 4.13 Combo chart

Stock Chart

Lakshmi selects Stock chart. But she is unable to create the chart. Her mother explains to her that a Stock chart displays the market trend given by opening price, bottom price, top price, and closing price. It can also be used for scientific data. For example, indicating temperature changes.

She helps Lakshmi to create a new worksheet containing stock data and lets Lakshmi create the Stock chart.

Date	High	Low	Close
11-Feb	186.54	126.55	187.00
12-Feb	187.56	138.98	189.00
13-Feb	188.93	159.56	190.02
14-Feb	189.91	110.76	191.56
15-Feb	167.76	118.52	168.52
16-Feb	165.87	120.72	167.23

Fig. 4.14 Data for stock chart

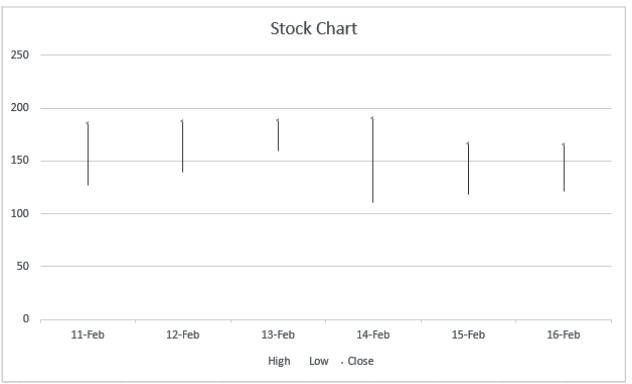


Fig. 4.15 Stock chart

Choosing a Right Type of Chart

'How will I know which chart type to use to display data?' Lakshmi asks her mother.

'Excel helps you when you don't know which chart type to use,' her mother replies.

She then clicks on the **Recommended Charts** command in the **Charts** group. The **Insert Chart** dialogue box opens. She tells Lakshmi that the left pane of the dialogue box shows suggestions of chart types based on the data selected by you.

'Select the desired chart in the left pane, and click on **OK**,' she tells Lakshmi and adds, 'The selected chart will be inserted in the worksheet.'

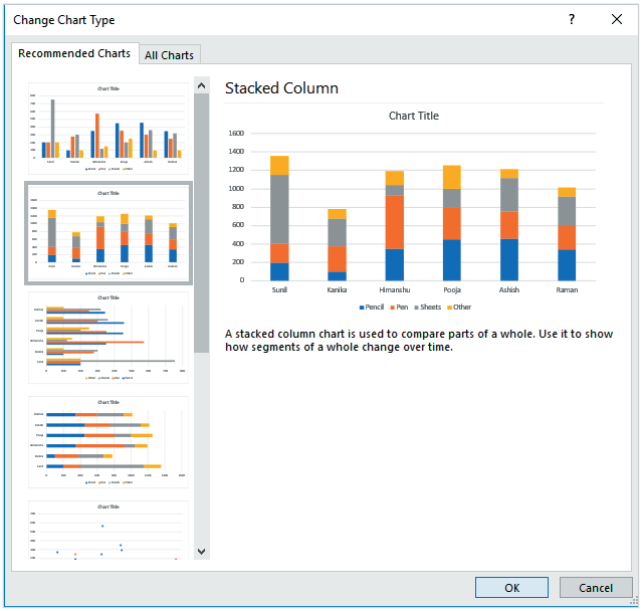

Change Chart Type
Recommended Charts
All Charts
Stacked Column
Chart Title
A stacked column chart is used to compare parts of a whole. Use it to show how segments of a whole change over time.
OK
Cancel

Fig. 4.16 Recommended Charts command

Quick Learn

Rahul has collected data from his father's company. It shows the month-wise sales of two regions. Help him create a combo chart for the data.

Month	Region 1	Region 2
Jan	200	657
Feb	250	600
Mar	300	500
Apr	254	300
May	345	200
Jun	234	100

Checkpoint

Answer the following questions.

1. List all the elements of a chart.
2. What is a legend?
3. The *x*-axis is a vertical axis. State true or false.
4. What do you understand by a data table?

Formatting a Chart

'What else can I do now in this chart?' Lakshmi asks her mother.

Her mother then explains to her that she can change the appearance of a chart, which is called formatting.

'Besides chart type, you can also change the text, font, colour, and border style in a chart,' says her mother.

On inserting a chart, the **Chart Tools** contextual tab appears on the ribbon. It contains two new tabs—**Design** and **Format**.

Did You Know?

A contextual tab is a hidden tab that is displayed when an object is selected.

Modifying Chart Layout

Lakshmi's mother tells her that Excel provides some predefined chart layouts and we can use these layouts instead of individually adding or modifying the components of a chart.

'Locate the **Quick Layout** button under the **Format** tab. When you click on the **Quick Layout** drop-down arrow, a menu appears. Select the desired layout style from the menu,' explains Lakshmi's mother.

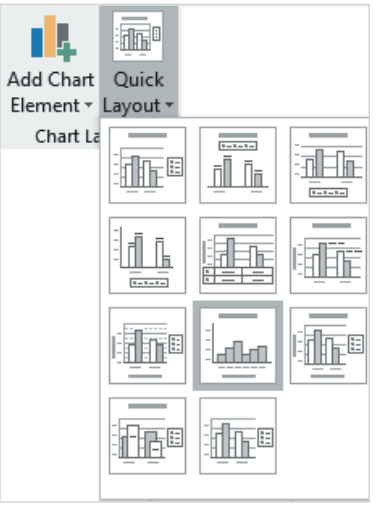


Fig. 4.17 Quick Layout option

Changing Chart Style

Lakshmi's mother moves to the **Chart Styles** group. There she clicks on the **More** button, which opens a list of predefined chart styles.

'You can select and click on the desired chart style to apply changes,' she tells Lakshmi.

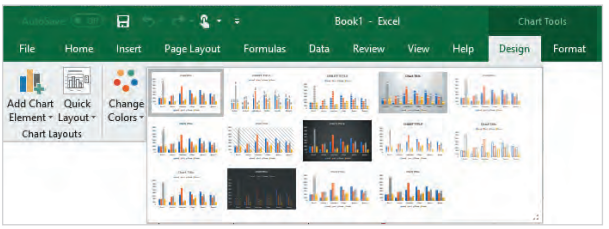


Fig. 4.18 Chart Styles options

Switching Row and Column Data

To switch row and column data, click the **Switch Row/Column** option in the **Data** group. The row and column data gets swapped.

Moving a Chart

Next, Lakshmi learns that we can also move a chart using the **Move Chart** command. She clicks on it and finds two options in the **Move Chart** dialogue box—**New sheet** and **Object in**. Her mother tells her the following:

- Select the **New sheet** option if you want to move the chart to a new sheet containing the chart.
- Select the **Object in** option if you want to move the chart to another worksheet. Select the worksheet in which you want to position the chart.

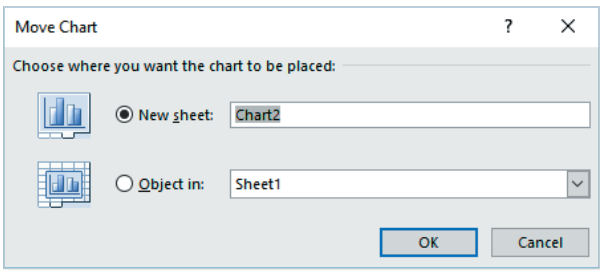


Fig. 4.19 Move Chart dialogue box

The Format Tab

Next, Lakshmi's mother introduces her to the **Format** tab. Her mother tells her that it offers various commands to format a chart such as changing the colour, adding effects, and changing shape styles.

Formatting Plot Area

Lakshmi's mother shows her the steps to change the colour of the plot area:

She right-clicks on the plot area and selects the **Format Plot Area...** option from the context menu. The **Format Plot Area** task pane appears on the right side of the screen. It has two icons—**Fill & Line** and **Effects**. She tells Lakshmi:

- Click on the **Fill & Line** icon to fill colour, texture or picture, or to apply border on a chart.
- Click on the **Effects** icon to apply 3-D, glow, or shadow effects.

Quick Tip

When you select a chart, three **Chart Formatting** buttons appear next to the chart.

Chart Elements: This button is used to add chart elements. Click on the check boxes against the elements you want to add.

Chart Styles: This button is used to add a colour and chart style.

Chart Filters: This button is used to add or remove series and categories labels on a chart.

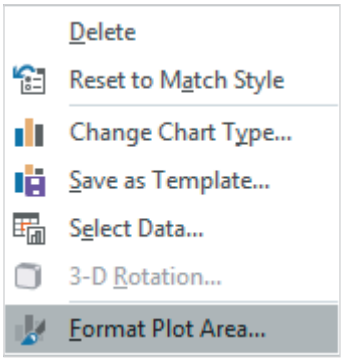


Fig. 4.20 Context menu

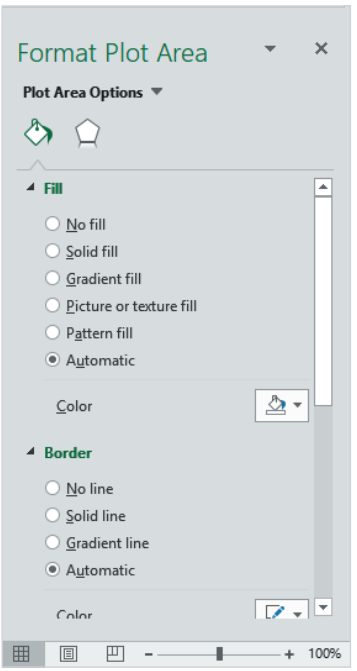


Fig. 4.21 Format Plot Area task pane

She then shows Lakshmi how the data series and chart area can be formatted using the **Format Data Series** and **Format Chart Area** task panes. She tells Lakshmi that when we click on any of the chart components, the respective format pane opens. We can then format the component as we desire. She then lets Lakshmi explore the options on her own.

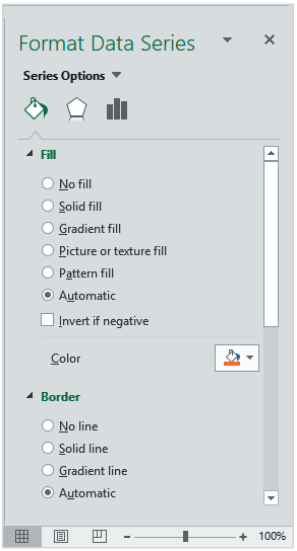


Fig. 4.22 Format Data Series task

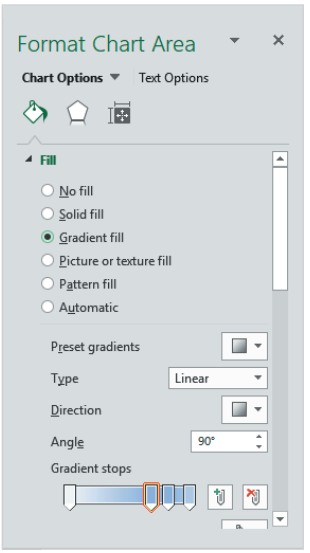


Fig. 4.23 Format Chart Area task

Quick Learn

Create a Pie chart for the given data. Format the chart by adding a background colour and changing the chart style.

Language	No. of People
Hindi	72000
English	75000
Punjabi	50000
Chinese	20000
French	15500

Adding Sparkline Charts

Lakshmi is enjoying creating various charts in Excel. She has created quite a few worksheets using the data that is there in her maths, science, and social science books.

One day, her elder brother, Raman, who studies in class 10, introduces her to a new type of chart—sparklines.

'A sparkline is a mini-chart that can help you get a quick analysis of your data,' Raman tells Lakshmi.

He shows Lakshmi three types of sparklines—**Line**, **Column**, and **Win/Loss**.

'Line and Column sparklines are miniature versions of Line and Column charts' he says, and also adds,'The win/loss sparkline is used when you have a negative data where Win means a positive value, Loss means a negative value, and Tie means a zero value.'

Creating a Sparkline

Raman shows Lakshmi how to create a Sparkline chart.

1. He first selects the data range for which he wants to create a sparkline.
2. He then clicks on the **Insert** tab and goes to the **Sparklines** group. There he selects the **Column Sparkline command.**
3. The **Create Sparklines** dialogue box opens. He enters the range of cells in the **Data Range** box and the cell address or a cell range in the **Location Range** box, and clicks on OK.

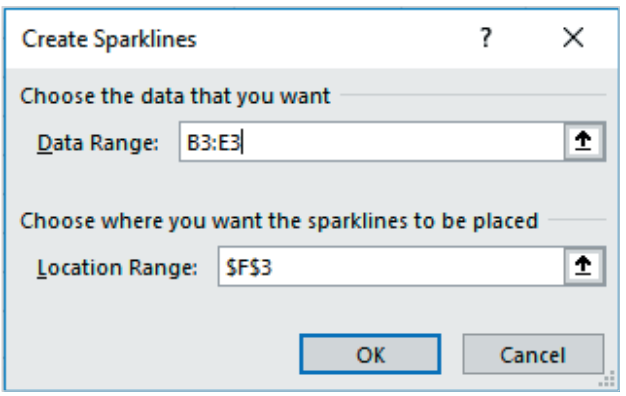


Fig. 4.24 Creating Sparklines dialogue box

	A	B	C	D	E	F
1	Expenditure on Various items					
2	Name	Pencil	Pen	Sheets	Other	Sparkline
3	Sunil	200	200	754	200	
4	Kanika	100	278	300	100	
5	Himanshu	350	572	120	150	
6	Pooja	450	352	200	250	
7	Ashish	456	300	360	100	
8	Raman	345	250	320	100	

Fig. 4.25 Column Sparklines

Quick Learn

Create a suitable set of data to add a Win/Loss sparkline in Excel.

Mark Data Points on Sparklines

Next, Raman shows Lakshmi how she can distinguish between high and low values and first and last points by using markers.

1. Click on one or more sparklines.
2. The **Design** tab under the **Sparkline Tools** contextual tab appears.
3. In the **Show** group, check the **Hight Point**, **Low Point**, **First Point**, and **Last Point** options. This will highlight the high, low, first, and last points.
4. You can change the colour of the sparklines by clicking on the **Sparkline Color** drop-down arrow in the **Style** group. A palette of colours appears. Select the desired colour from the palette. The colour of the sparklines will change.
5. You can also change the colour of the markers by selecting a desired colour from the **Marker Color** drop-down arrow.
6. To change the sparkline type, click on the desired sparkline type in the **Type** group.

The sparklines will appear.

	A	B	C	D	E	F
1	Expenditure on Various items					
2	Name	Pencil	Pen	Sheets	Other	Sparkline
3	Sunil	200	200	754	200	
4	Kanika	100	278	300	100	
5	Himanshu	350	572	120	150	
6	Pooja	450	352	200	250	
7	Ashish	456	300	360	100	
8	Raman	345	250	320	100	

Fig. 4.28 Line Sparklines

	A	B	C	D	E	F
1	Expenditure on Various items					
2	Name	Pencil	Pen	Sheets	Other	Sparkline
3	Sunil	200	200	754	200	
4	Kanika	100	278	300	100	
5	Himanshu	350	572	120	150	
6	Pooja	450	352	200	250	
7	Ashish	456	300	360	100	
8	Raman	345	250	320	100	

Fig. 4.26 Data Points on Sparklines

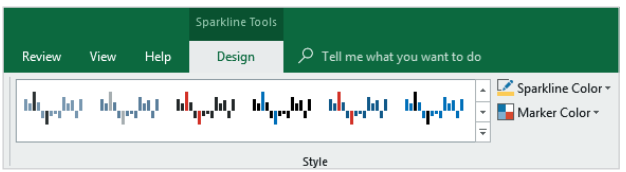


Fig. 4.27 Marker Color options

Quick Tip

To remove a sparkline, follow these steps:

1. Select the sparkline.
2. Click on the **Design** tab under the **Sparklines** tools contextual tab.
3. In the **Group** group, click on the **Clear** drop-down arrow.
4. Select the **Clear Selected Sparkline.**

Key Terms

Chart	A graphical representation of data
Legend	A description about the data series
Plot area	An area of a chart in which the data is plotted
Chart area	The total area where a chart and its components are placed
Data table	The set of data values from which a chart is created
Gridlines	The horizontal or vertical lines that run across the plot area
Data label	A label that provides an additional information about a data point
Major gridlines	Gridlines that are organized at large intervals
Minor gridlines	Gridlines that are organized at smaller intervals
Sparkline	A miniature chart that can be embedded in a single cell

Recap

- Charts provide an easier way to understand and read data.
- A chart has several components, such as chart title, plot area, gridlines, legend, axes title, *x*-axis, *y*-axis, data label, data table, and chart area.
- There are various predefined charts that can be used to create a chart in Excel.
- Column chart, Line chart, Pie chart, Bar chart, Area chart, and Scatter chart are some of the different types of charts.
- To insert a chart, click the Insert tab and choose the desired chart type.
- When a chart is selected, two tabs—Design and Format—appear under the Chart Tools tab.
- The Design tab offers commands to change the layout and appearance of a chart.
- The Format tab offers commands to format the various components of a chart.
- Sparklines are miniature charts that can be accommodated in an individual cell. These are used to quickly analyze the data.

Exercise

A. Choose the correct options.

1. Name the element used to describe the data series in a chart.
   a) Axis b) Data point c) Legend d) Title
2. Name the element that is used to give a heading to a chart.
   a) Legend b) Title c) Axis d) Data series
3. Which of the following statements describes the *y*-axis of the chart?
   a) It is the horizontal axis.
   b) It is the vertical axis.
   c) It defines the data series.
   d) It defines a title for the chart.
4. Which of the following function keys is used to insert a chart in a new Sheet tab?
   a) F9 b) F10 c) F11 d) F12
5. Which of the following options represents the correct method for inserting a heading for a chart?
   a) Click on the Design tab > Add Chart Element > Chart Title
   b) Click on the Layout tab > Insert Chart Heading
   c) Click on the Layout tab > Add Chart Title
   d) Click on the Format tab > Format Chart Title

B. State *true* or *false*.

1. The *x*-axis is also known as the category axis.
2. We cannot modify a chart by changing its layout and style.
3. A Pie chart represents only one type of data series.
4. Legends are the horizontal or vertical lines that extend from the axes and run across the plot area.
5. We can move a chart from one worksheet to another.

C. Fill in the blanks.

1. To create a chart, click on the _____ tab.
2. The _____ chart represents data in rectangles.
3. The Chart Tools contextual tab has two tabs _____ and _____.
4. The _____ are the miniature charts.
5. In the _____ chart, categories are organized horizontally, and values are organized vertically.

D. Answer the following questions.

1. What is a chart? How is it useful?
2. Name the different components of a chart.
3. List the steps to insert a chart in Excel.
4. Write the steps to create a Column chart adding various components to it.
5. List down the steps to change a Column chart into a Scatter chart.

Application-based Questions

1. There are a total of 35 students in a class. Twenty-two of them appeared for the test, eight were absent, and five could not appear for the test as they had training going on for an interschool dance competition. Create a Pie chart and show the data in percentage.
2. Sanya has created a Column chart for the data shown below. She now wants to change it into a Bar chart. How can she do that? List the steps.

Sanya's Time Management Table	
Study	2 hours
Play	1.5 hours
Watch TV	1 hour
Curricular activities	2 hours

3. Rahul created a chart on 'monthly expenditure' of his family. He wants to move the chart to a new worksheet. How can he do that? Write the steps.

Lab Activity

1. Open a new workbook and enter the data as shown below. Create a Column chart and format the chart by adding a background colour, chart title, and legends.

Item	Quantity	Price of each
Pencil	50	10
Pen	40	30
Eraser	20	5
Notebook	10	50

2. Your geography teacher wants you to create a combo chart for the data given below. How will you do that?

State	Population	Area(Km^2)
Uttar Pradesh	19,98,12,341	2,40,928
West Bengal	9,12,76,110	88,752
Tamil Nadu	72,34, 030	1,00,564
Rajasthan	18,54,830	3,53,289
Karnataka	2,87,239	1,91,900

3. Your uncle has shared some data with you. He wants you to create a suitable chart for the data. He also wants you to format the data on the given points.

Process Phases	January (in ₹)	February (in ₹)	March (in ₹)	April (in ₹)
R&D	12000	12875	23795	32723
Development	22000	89765	47403	34987
Testing	17000	64849	22000	19000
Marketing	25000	48474	29000	37393

a) Add an appropriate chart title above the chart.
b) Add a colour to the background of the chart.
c) Display legend on the left side.
d) Display data table without legend below the chart.
e) Explain how this chart will help your uncle

Project

1. Collect maximum and minimum temperatures of the last five days. Create a Line chart and compare the data. Also format the chart by changing the chart style. Take a printout of the chart and show it in your class. Explain what you have understood from the chart.
2. Prepare a data set showing the marks of ten students of your class in five subjects. Create different charts for the same data set. You may not be able to create some types of charts for the data. Make a note of that, and find out the reasons.

Explore More

- Discuss how 3-D charts can be useful for presenting data.
- Find out how formula and functions can be used on charts.

Weblinks

- https://support.office.com/en-us/article/create-a-chart-in-excel-2016-for-mac-9407d77e-9695-488a-8e0a-7cb3fd507862
- https://support.office.com/en-us/article/create-a-chart-from-start-to-finish-0baf399e-dd61-4e18-8a73-b3fd5d5680c2

Notes for the Teacher

- Explain the usefulness of charts.
- Show them different types of charts using suitable data.
- Give them enough examples to create and format charts.
- Stress on how charts help us understand data better.

5 Formulas and Functions in Excel

After going through this chapter, you will be able to—

- **use** formulas in Excel;
- **compare** the types of cell references;
- **use** functions in Excel; and
- **identify** the types of formula errors.

Formulas in Excel

Vinayak often sees his elder sister, Vinita, working on Excel. She is a senior accountant in a company. She has told Vinayak that Excel does complex mathematical calculations very fast. But what excites him more is the fact that we can create our own formula and enter it in Excel to do rapid calculations. He wants to know how a formula in Excel would be like. Vinita tells him that a formula in Excel always begins with an equality '=' symbol.

Next day, Vinayak goes to his computer teacher, Ms Anu Verma, and expresses his curiosity about how formulas are used in Excel.

'We will learn about it in the computer lab tomorrow,' she assures him.

Next day, Ms Verma begins the class by explaining that a formula in Excel can be a combination of one or more elements:

- Constants: 98, 62, Neha
- Cell references (cell addresses): C3, B3:B7
- Operators: +, -, /, *
- Functions (predefined formulas is more conventional and simpler.): sum, max, average

Entering a Formula in Excel

Ms Verma opens a worksheet and asks Vinayak to type some numbers in it.

'Now let me show you how to find the sum of these numbers,' she tells the class.

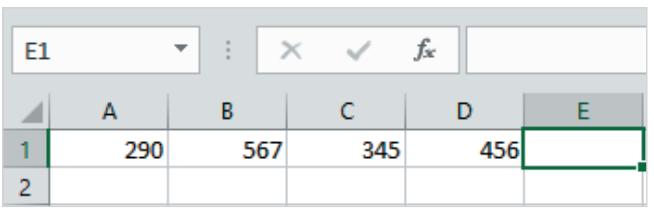


Fig. 5.1 Entering data in Excel

She clicks on the cell E1 and types '=A1+B1+C1+D1' in the cell.

'Now, press the Enter key,' she asks Vinayak.

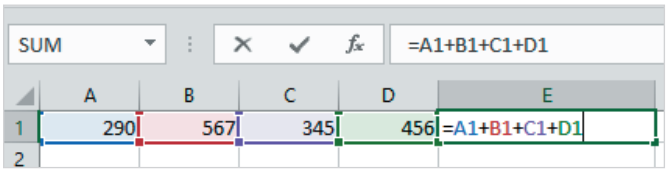


Fig. 5.2 Typing the formula

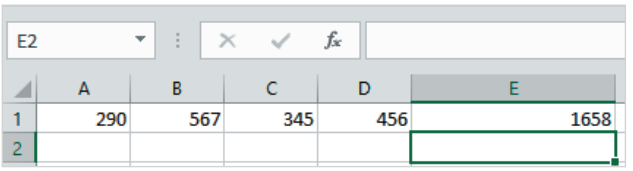


Fig. 5.3 Result after entering the formula

The sum of the values entered in the cells A1, B1, C1, and D1 gets displayed in the cell E1.

Using the Pointing Method

'Can I add a formula by clicking on the cells instead of typing the cell addresses?' Vinayak asks Ms Verma.

'Yes, this is known as the pointing method,' Ms Verma tells the class.

She opens a new worksheet.

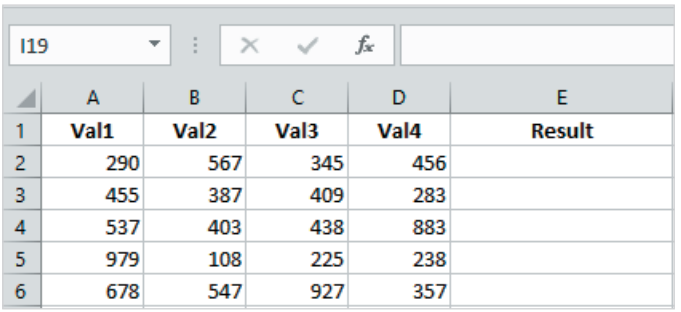


Fig. 5.4 Data set

She types '=' in the cell E2 and clicks on the cell A2. A dashed border around the cell A2 appears. Next, she types '+' and clicks on the cell B2.

She then asks Aahana to type '+' and click on the cell C2.

'Now type "+" and click on the cell D2,' she tells Aahana.

'How will you see the result now?' she asks the class.

'By pressing the Enter key or the Enter button,' the whole class replies.

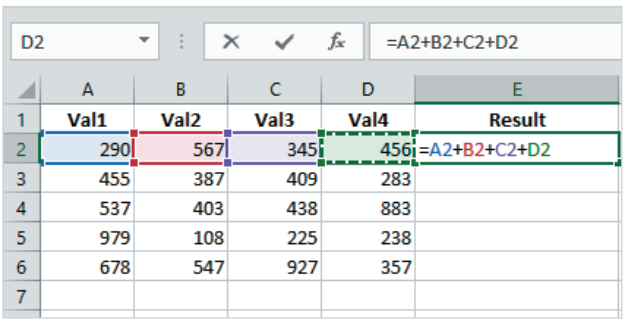
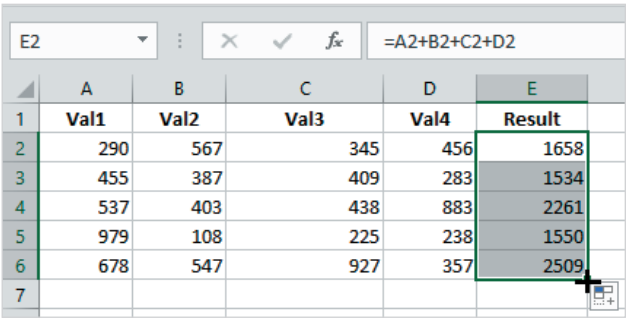


Fig. 5.5 Entering formula by pointing method

Next, she moves the mouse pointer to the bottom right corner of cell E2. A Fill handle (small plus sign) appears. She drags the Fill handle to the cell E6 to complete the rest of the entries—Excel copies the formula in E1 to cells E2 to E6.



	A	B	C	D	E
1	Val1	Val2	Val3	Val4	Result
2	290	567	345	456	1658
3	455	387	409	283	1534
4	537	403	438	883	2261
5	979	108	225	238	1550
6	678	547	927	357	2509
7					

Fig. 5.6 Result after using formula by pointing method

Using Formula on Text

The children are amazed when Ms Verma tells them that they can use formulas on text also.

'Does that mean we can add text to Excel?' Vinayak asks.

'Yes, we can add sequence of characters or symbols and that includes text' she tells him. She explains to the class that the ampersand (&) operator is used to perform addition on string values. Addition of two or more strings is also known as **string concatenation**.

She then opens a new worksheet and follows these steps.

1. She enters string values in cells A1 and B1—'Using' in cell A1 and 'Functions' in cell B1.
2. Then she types the formula in cell C1 as '=A1&B1' and presses the Enter key.

Fig. 5.7 String concatenation

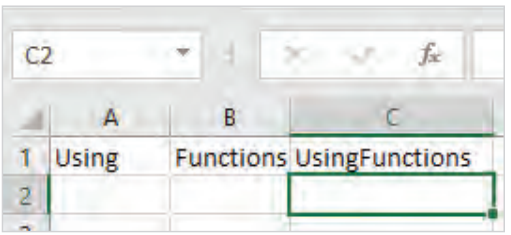


Fig. 5.8 Result after string concatenation

The result 'UsingFunctions' is displayed in the cell C1.'There is no space between the words,' says Aahana.

Ms Verma tells Aahana that to add a blank space, you need to enter the formula in the cell as '=A1&" "&B1'.

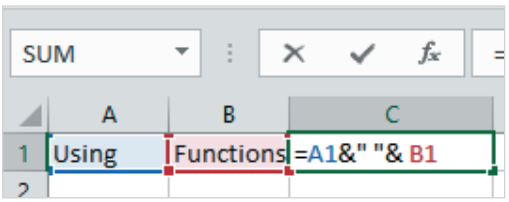


Fig. 5.9 String concatenation with white space

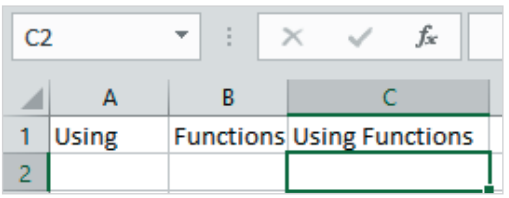


Fig. 5.10 Result after string concatenation with white space

Cell Reference

Ms Verma tells the class that when you create a formula, it usually refers to cells or cell ranges. A reference identifies a cell or a range of cells in a worksheet and notifies Excel where to look for the values or data.

There are three types of cell references—relative, absolute, and mixed.

Did You Know?

The cell reference is also called the cell address.

Ms Verma tells the class, 'Cell references play an important role when you copy formulas. For example, if the formula you have created refers to the cell C2 and you change the value in the cell C2, the formula will change to reflect the new values. If you did not use cell references, you would need to make changes in the formulas manually.

She then illustrates examples to explain the three types of cell references.

Relative Reference

When you copy a formula from one cell to another, the row and column references change. Ms Verma opens a new worksheet. She tells the class that here 'Total' is the product of 'Price' and 'Quantity' and the formula in the cell D2 is '=B2*C2'.

Ms Verma uses the Fill handle to drag the formula and the formula is copied from the cell D3 to D10. She tells the class that you can also simply copy the formula from the cell D2 to D10.

SUM | =B2*C2

	A	B	C	D
1	Item	Price	Quantity	Total
2	Hair dryer	2500	10	=B2*C2
3	Washing machine	18000	15	
4	Microwave	7000	32	
5	Oven	5000	34	
6	Regrigerator	45000	54	
7	Air conditioner	50000	12	
8	Tubelight	200	76	
9	Fan	2000	45	
10	Bulb	50	36	

Fig. 5.11 Relative cell reference

When you copy a formula to a different cell, the formula is not exactly the same as the original cell. For example, take the formula in the cell D2—'=B2*C2'. If this formula is copied to the cell D5, it will read '=B5*C5'.

D2 | =B2*C2

	A	B	C	D
1	Item	Price	Quantity	Total
2	Hair dryer	2500	10	25000
3	Washing machine	18000	15	270000
4	Microwave	7000	32	224000
5	Oven	5000	34	170000
6	Regrigerator	45000	54	2430000
7	Air conditioner	50000	12	600000
8	Tubelight	200	76	15200
9	Fan	2000	45	90000
10	Bulb	50	36	1800

Fig. 5.12 Drag the Fill handle

D5 | =B5*C5

	A	B	C	D
1	Item	Price	Quantity	Total
2	Hair dryer	2500	10	25000
3	Washing machine	18000	15	270000
4	Microwave	7000	32	224000
5	Oven	5000	34	170000
6	Regrigerator	45000	54	2430000
7	Air conditioner	50000	12	600000
8	Tubelight	200	76	15200
9	Fan	2000	45	90000
10	Bulb	50	36	1800

Fig. 5.13 Formula in the selected cell

Absolute Reference

This type of reference does not change when you copy the formula to another cell. To make an absolute reference in a formula, a dollar sign ($) is added before the row numbers and column letters. For example, B5 is an absolute reference.

'Let us calculate 10% discount on each item,' Ms Verma tells the class and does the following:

- She types 10% in the cell B13.
- Now in the cell E2, she types '=D2*B13'.

Ms Verma next tells the class that in the formula used, the first cell address D2 is a relative reference as there is no dollar sign used.

The second cell address is absolute reference. When this formula is copied, the first cell address will change but the second cell address will remain the same.

A13 | Discount to be given

	A	B	C	D	E
1	Item	Price	Quantity	Total	Discount
2	Hair dryer	2500	10	25000	
3	Washing machine	18000	15	270000	
4	Microwave	7000	32	224000	
5	Oven	5000	34	170000	
6	Regrigerator	45000	54	2430000	
7	Air conditioner	50000	12	600000	
8	Tubelight	200	76	15200	
9	Fan	2000	45	90000	
10	Bulb	50	36	1800	
11					
12					
13	Discount to be given	10%			

Fig. 5.14 Data set

SUM | =D2*B13

	A	B	C	D	E
1	Item	Price	Quantity	Total	Discount
2	Hair dryer	2500	10	25000	=D2*B13
3	Washing machine	18000	15	270000	
4	Microwave	7000	32	224000	
5	Oven	5000	34	170000	
6	Regrigerator	45000	54	2430000	
7	Air conditioner	50000	12	600000	
8	Tubelight	200	76	15200	
9	Fan	2000	45	90000	
10	Bulb	50	36	1800	
11					
12					
13	Discount to be given	10%			

Fig. 5.15 Absolute cell reference

She asks Vinayak to come forward and drag the Fill handle.

The rest of the cells are filled.

E2 | =D2*B13

	A	B	C	D	E
1	Item	Price	Quantity	Total	Discount
2	Hair dryer	2500	10	25000	2500
3	Washing machine	18000	15	270000	27000
4	Microwave	7000	32	224000	22400
5	Oven	5000	34	170000	17000
6	Regrigerator	45000	54	2430000	243000
7	Air conditioner	50000	12	600000	60000
8	Tubelight	200	76	15200	1520
9	Fan	2000	45	90000	9000
10	Bulb	50	36	1800	180
11					
12					
13	Discount to be given	10%			

Fig. 5.16 Dragging the Fill handle

Quick Learn

The worksheet given below shows the sales of a company. Calculate the net sales.

	A	B	C
1	Month	Sales (in ₹)	Net Sales (Sales–Tax)
2	Jan	2387	
3	Feb	9548	
4	Mar	4986	
5	Apr	3409	
6	May	3434	
7	Jun	9709	
8			
9	Tax	10%	

Mixed Reference

Ms Verma tells the class that mixed reference is a combination of relative and absolute cell references.

'In this type of reference, either a row or a column number remains constant, she tells the class. For example, $A1 + A$2 is a mixed cell reference.

She applies it in the sheet as shown in Fig. 5.17.

Remember

When a formula containing an absolute reference is copied from one location to another, the cell reference does not change.

	A	B	C	D	E	F	G
1					Discount Options		
2					10%	15%	20%
3	Item	Price	Quantity	Total	Discount Amount		
4	Hair dryer	2500	10	25000	2500	3750	5000
5	Washing machine	18000	15	270000	27000	40500	54000
6	Microwave	7000	32	224000	22400	33600	44800
7	Oven	5000	34	170000	17000	25500	34000
8	Regrigerator	45000	54	2430000	243000	364500	486000
9	Air conditioner	50000	12	600000	60000	90000	120000
10	Tubelight	200	76	15200	1520	2280	3040
11	Fan	2000	45	90000	9000	13500	18000
12	Bulb	50	36	1800	180	270	360

Fig. 5.17 Mixed cell reference

Ms Verma explains to the class:

'The formula for calculating Discount is 'Total * Discount%'. The discount has to be calculated for three different discount rates. As the total price is in column D, this column is fixed, but the row for each item is varying. In case of discount, rates are in row 2, which is fixed, but the columns are different. Hence, mixed referencing is being used here for the total price and discount.'

Circular Reference

'When a formula refers to its own cell address, a circular reference occurs,' Ms Verma explains to the class.

Ms Verma now emphasizes that sometimes, while entering a formula, we inadvertently use the same cell address in which the formula is entered.

'Always avoid circular errors,' she tells the class.

She also explains to the class how to correct the circular reference if it has crept into a formula while entering it.

'When it happens, you will find a warning dialogue box on the screen.

Click on **OK** to close the dialogue box. The value in the cell changes to 0. Re-enter the formula.'

Quick Tip

To switch between the types of references, follow these steps:

- Select the cell that contains the formula.
- On the formula bar, select the cell reference.
- Press F4 key to toggle between the references.

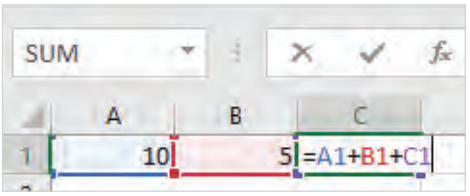


Fig. 5.18 Circular cell reference

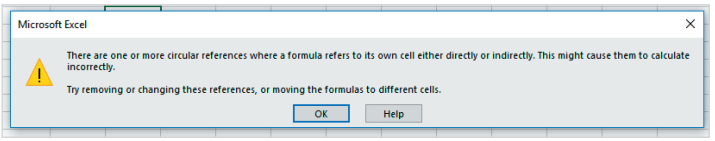

Microsoft Excel
There are one or more circular references where a formula refers to its own cell either directly or indirectly. This might cause them to calculate incorrectly.
Try removing or changing these references, or moving the formulas to different cells.
OK
Help

Fig. 5.19 Warning message

Reference to Another Worksheet

Now, Ms Verma explains to the class that cell references can be copied from one worksheet to another. She shows two ways to the class to use these references—copy and paste method and sheet reference method.

Quick Tip

To switch between the types of references, follow these steps:

- Select the cell that contains the formula.
- On the Formula bar, select the cell reference.
- Press F4 key to toggle between the references.

Copy and Paste Option

This time, Ms Verma asks Roshini to come forward. She then guides her through the following steps:

- Roshini clicks on the **New Sheet** button . A new sheet is added in the name of 'Sheet2' to the same workbook. Ms Verma asks her to enter the same data as in Sheet 1.
- Ms Verma now asks Roshini to click on the **Sheet1** tab and copy the formula in the cell B8 using **Ctrl + C** command.
- Roshini now clicks on the cell B8 on **Sheet2** and and pastes the formula using the keyboard shortcut **Ctrl + V**.

B8 =SUM(B2:B6)

	A	B
1	**Item**	**Price**
2	Bulb	50
3	Tubelight	200
4	Oven	5000
5	Washing machine	18000
6	Regrigerator	45000
7		
8	**Total**	68250

Fig. 5.20 Using copy and paste method

The cell displays the result. Ms Verma emphasizes that if a formula is copied without data, the result will be zero.

Sheet Reference Method

Next, Ms Verma asks Aruna to come forward.'We will now subtract the discount given on the total amount,' she tells the class. With guidance from Ms Verma, Aruna follows these steps:

- She clicks on cell B8 of **Sheet2**.
- She types '=SUM(B2:B6)-Sheet1!B9' and presses the Enter key.

'This will sum the values in the cell from B2 to B6, and then subtract the value stored in the cell B9 of sheet1,' Ms Verma explains to the class. Now the bell rings. She asks the class to work on the different types of references in Excel on their computers at home. Just before she leaves, she adds, 'Children, I want you to also try functions in Excel. I will teach you about functions in Excel tomorrow'.

B8 | =SUM(B2:B6)-Sheet1!B9

	A	B	C
1	**Item**	**Price**	
2	Bulb	50	
3	Tubelight	200	
4	Oven	5000	
5	Washing machine	18000	
6	Regrigerator	45000	
7			
8	**Total**	58250	

Fig. 5.21 Using sheet reference method

Quick Tip

In Excel, formulas are always displayed in upper case. Even if you type a formula in lower case, Excel automatically converts them to upper case.

Functions in Excel

In the next class, Ms Verma starts with functions in Excel. She explains to the class that in Excel, functions are defined as built-in formulas that are used to perform calculations or to return information about your spreadsheet data.

'These functions are organized into categories, such as text, logical, and math, to help you to locate the function you need from the Excel menu,' she adds.

She gives an example, 'Instead of adding the cell values using the "+" operator, you can use the SUM function available in Excel.'

Remember

Arguments contain the information you want to calculate. They are always enclosed in parentheses.

Next, she explains arguments of a function:

'When you need to use a function, you have to specify the values that the function will use. These values are called arguments of the function. Functions always begin with an equals '=' sign followed by the function name, which is followed by the arguments. Arguments are always enclosed in parentheses.'

Rules for Writing a Function

'Here are the rules for writing a function,' Ms Verma elaborates:

- A function should start with an equals '=' sign followed by the function name.
- A function name can be written in upper case or lower case.
- Arguments should be enclosed within parentheses.
- No blank space should be given between the equal symbol, function name, and arguments.
- If there is more than one argument in a function, a comma should be used to separate the arguments.

She then writes =SUM(3, 4) in cell A1 and presses Enter. It produces the result as 7.

Remember

There should not be any space in a formula. Remove spaces if a formula does not work.

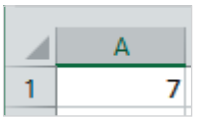


Fig. 5 22 Result after entering the SUM function

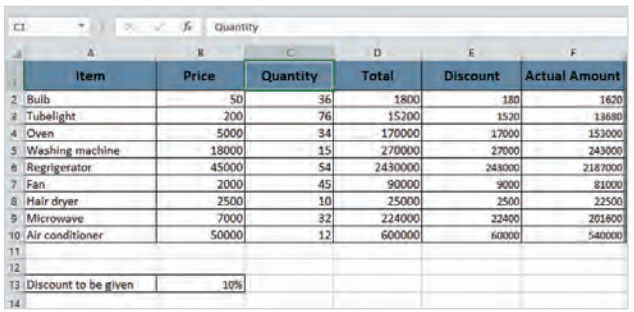
Some Common Functions

Ms Verma now introduces the class to some common predefined functions available in Excel.

AutoSum

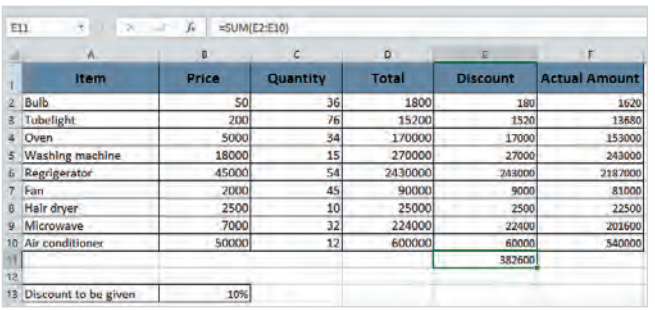
Ms Verma opens a new worksheet and shows how to use the AutoSum feature.

- She clicks on the cell E11, where she wants the result to appear and then on the **AutoSum** command in the **Editing** group.
- A dashed border around the range of cells E2:E10 appears. She presses the Enter key and the sum gets displayed.



	A	B	C	D	E	F
1	Item	Price	Quantity	Total	Discount	Actual Amount
2	Bulb	50	36	1800	180	1620
3	Tubelight	200	76	15200	1520	13680
4	Oven	5000	34	170000	17000	153000
5	Washing machine	18000	15	270000	27000	243000
6	Regrigerator	45000	54	2430000	243000	2187000
7	Fan	2000	45	90000	9000	81000
8	Hair dryer	2500	10	25000	2500	22500
9	Microwave	7000	32	224000	22400	201600
10	Air conditioner	50000	12	600000	60000	540000
11						
12						
13	Discount to be given	10%				
14						

Fig. 5.23 Data set



	A	B	C	D	E	F
1	Item	Price	Quantity	Total	Discount	Actual Amount
2	Bulb	50	36	1800	180	1620
3	Tubelight	200	76	15200	1520	13680
4	Oven	5000	34	170000	17000	153000
5	Washing machine	18000	15	270000	27000	243000
6	Regrigerator	45000	54	2430000	243000	2187000
7	Fan	2000	45	90000	9000	81000
8	Hair dryer	2500	10	25000	2500	22500
9	Microwave	7000	32	224000	22400	201600
10	Air conditioner	50000	12	600000	60000	540000
11					382600	
12						
13	Discount to be given	10%				

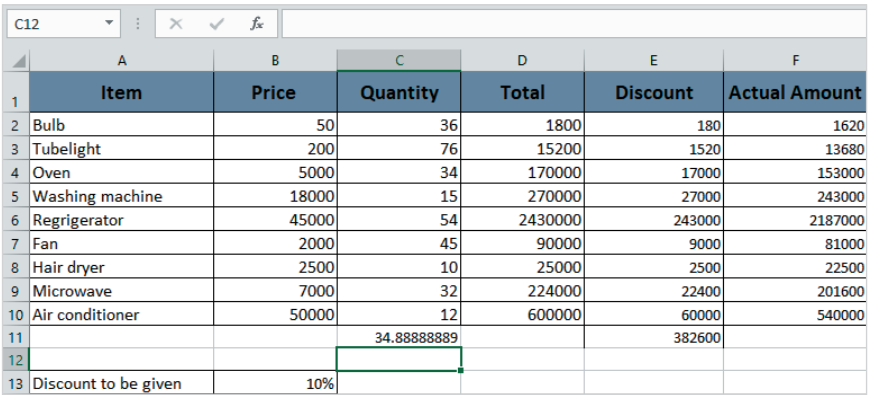
Fig. 5.24 Using the AutoSum feature

She tells the students that the AutoSum feature is used to not only find the sum of the given numbers but also to find the average, count, maximum, and minimum of a range of cells.

Average()

Here is how Ms Verma shows the use of AVERAGE() function.

- She clicks on the cell C11, where she wants the result, and types the formula as '=average(C2:C10)'.
- She presses the Enter key to see the results.



	A	B	C	D	E	F
1	Item	Price	Quantity	Total	Discount	Actual Amount
2	Bulb	50	36	1800	180	1620
3	Tubelight	200	76	15200	1520	13680
4	Oven	5000	34	170000	17000	153000
5	Washing machine	18000	15	270000	27000	243000
6	Regrigerator	45000	54	2430000	243000	2187000
7	Fan	2000	45	90000	9000	81000
8	Hair dryer	2500	10	25000	2500	22500
9	Microwave	7000	32	224000	22400	201600
10	Air conditioner	50000	12	600000	60000	540000
11			34.88888889		382600	
12						
13	Discount to be given	10%				

Fig. 5.25 Using the average function

Max() and Min()

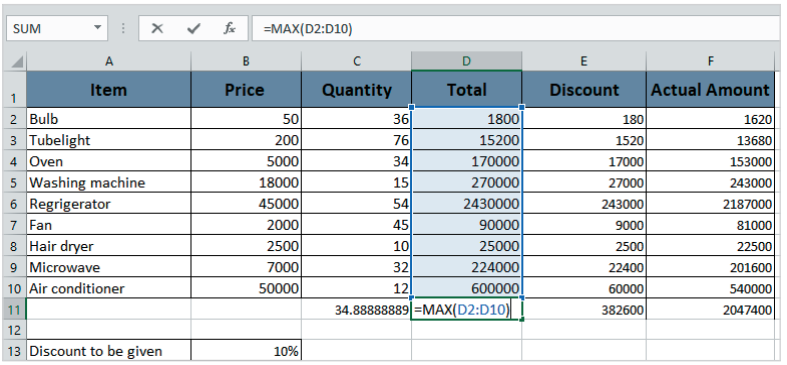
'The MAX() function is used to find the largest value from a specified set of values,' Ms Verma tells the class and asks Vinayak to come forward and try the following steps.

- Click on the cell D11, where you want to get the output.
- Type the formula as '=max(D2:D10)'.
- Press the Enter key and see the results.

She then tells the class that similarly the MIN() function is used to find the minimum value.

Did You Know?

You can convert any number to a Roman number by using the formula '=ROMAN(number)'.



	A	B	C	D	E	F
1	Item	Price	Quantity	Total	Discount	Actual Amount
2	Bulb	50	36	1800	180	1620
3	Tubelight	200	76	15200	1520	13680
4	Oven	5000	34	170000	17000	153000
5	Washing machine	18000	15	270000	27000	243000
6	Regrigerator	45000	54	2430000	243000	2187000
7	Fan	2000	45	90000	9000	81000
8	Hair dryer	2500	10	25000	2500	22500
9	Microwave	7000	32	224000	22400	201600
10	Air conditioner	50000	12	600000	60000	540000
11			34.88888889	=MAX(D2:D10)	382600	2047400
12						
13	Discount to be given	10%				

Fig. 5.26 Using the max and min functions

Count()

'Let us count the number of numeric values in column F,' Ms Verma tells the class and types the formula '=count(F2:F10)'. She then tells the class that this is the count function and it gives you the numeric count.

F11 =COUNT(F2:F10)

	A	B	C	D	E	F
1	Item	Price	Quantity	Total	Discount	Actual Amount
2	Bulb	50	36	1800	180	1620
3	Tubelight	200	76	15200	1520	13680
4	Oven	5000	34	170000	17000	153000
5	Washing machine	18000	15	270000	27000	243000
6	Regrigerator	45000	54	2430000	243000	2187000
7	Fan	2000	45	90000	9000	81000
8	Hair dryer	2500	10	25000	2500	22500
9	Microwave	7000	32	224000	22400	201600
10	Air conditioner	50000	12	600000	60000	540000
11						9
12						
13	Discount to be given	10%				

Fig. 5.27 Using the count function

Quick Tip

You can also use the AutoSum drop-down list options to insert the average, count, max, and min functions.

Functions Library

Ms Verma next moves on to another fascinating feature of functions. Excel has a large function library that offers a wide variety of functions, which are categorized by their functionality. She then introduces the children to the most common functions in the **Math & Trig** category and **Date & Time** category.

Quick Learn

Given below is a worksheet of a company. It shows the sales in the months of January to June. Find out the sum, average, maximum and minimum of sales (using functions).

Month	Sales (in ₹)
Jan	2387
Feb	9548
Mar	4986
Apr	3409
May	3434
Jun	9709
Sum	
Average	
Max	
Min	

LCM()

The children are familiar with LCM (least common multiple). Now, they know that the LCM() function in Excel should return the least common multiple of two or more values. Ms Verma shows the class how to find the LCM in Excel:

1. Enter the values in the cells, and select the cell where you want to get the output.
2. Click on the **Formulas** tab, and then click on **Math & Trig.**
3. Select **LCM** from the list that opens.

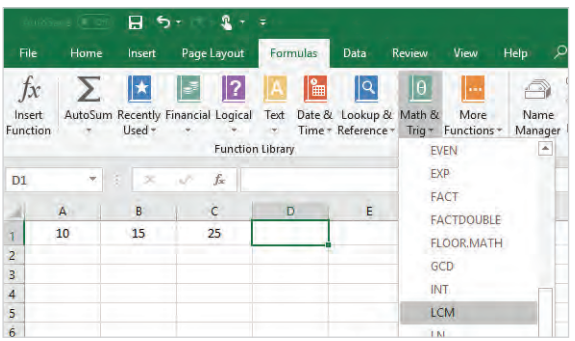


Fig. 5.28 LCM function

4. The **Function Arguments** dialogue box appears. Type the cell address in the **Number** boxes.
5. Click on **OK**. The output will appear in the cell D1.

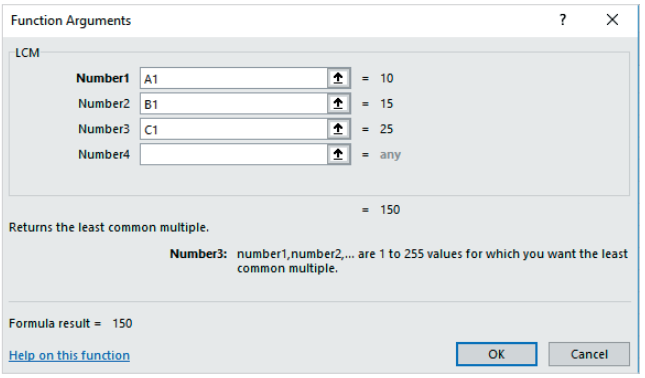


Fig. 5.29 Function Arguments dialogue box

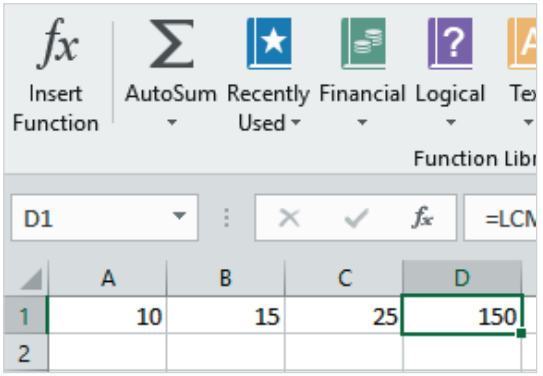


Fig. 5.30 Output after using the LCM () function

GCD()

The class guesses that GCD() function is used to calculate the greatest common divisor of two or more values. Ms Verma asks a few children to show how they can use it. They start the procedure similar to finding the LCM.

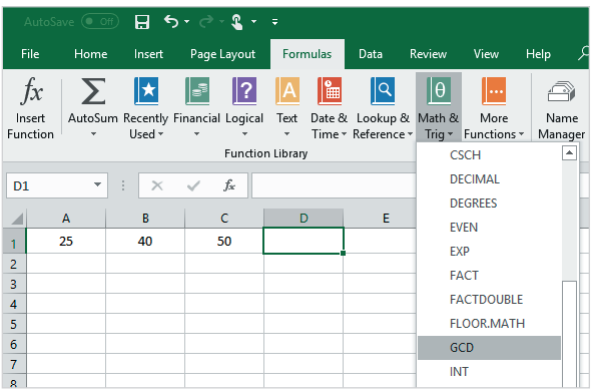


Fig. 5.31 GCD function

1. The **Function Arguments** dialogue box appears. They type the cell address in the **Number** boxes.
2. They click on **OK**. The output appears in the cell D1.

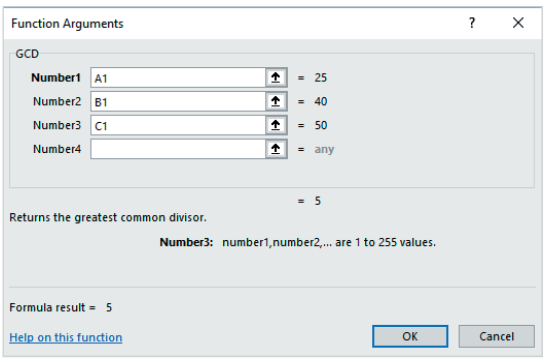


Fig. 5.32 Function Arguments dialogue box

Did You Know?

You can display the formulas used in each cell instead of the result produced by the formulas by selecting the Show Formulas command on the Formulas tab.

Ms Verma now lists some of the common **Math & Trig** functions as shown in the table given below.

Function	Description	Example
INT(number)	It rounds a number to the nearest integer.	=INT(5.999) will result in 5
ODD(number)	It rounds the number to the nearest odd integer, which is greater than the number.	=ODD(68.6) will result in 69
ROUND(number, num_digit)	It rounds a number to the number of digits specified.	=ROUND(34.1234, 2) will result in 34.12
SQRT(number)	It finds the square root of a number.	=SQRT(144) will result in 12
MOD(number, divisor)	It returns the remainder when a number is divided by a divisor.	=MOD(12, 5) will result in 2
POWER(number, power)	It returns the result of a number raised to a power.	=POWER(5, 2) will result in 25
FLOOR(number, significance)	It rounds the number to the nearest specified multiple.	=FLOOR(13, 5) will result in 10

Today()

Ms Verma next goes to the **Date & Time** category and tells the class about the Today() function. She explains to the children that it displays the current date. She also shows them some more date and time functions.

Function	Description
=Month(Today())	It displays the value of the current month in the number form.
=Year(Today())	It displays the value of the current year in the number form.
=Day(Today())	It displays the value of the current day in the number form.
=Text(Today(),“DDDD”)	It displays the value of the current day in the text form.
=Text(Today(),“MMMM”)	It displays the value of the current month in the text form.
=Text(Today(),“YYYY”)	It displays the value of the current year in the text form.

Checkpoint

Write the use of each of the given functions.

1. =MOD()
2. =MAX()
3. =Day(Today())
4. =Year(Today())
5. =LCM()

The Insert Function Button

Ms Verma now goes to the **Insert Function** button f_x located to the left of the formula bar.

'You can use this button to create a formula,' she tells the class and shows the class how it can be used.

1. After clicking on the **Insert Function** button, the **Insert Function** dialogue box appears on the screen.
2. Click on the down arrow next to the **Or select a category** box and select **All** option.
3. Under the **Select a function** box, select the function you wish to use and then click on **OK**.
4. The **Function Arguments** dialogue box opens. You can enter the values or cell references in the Number1, Number2 boxes.
5. When you are done, click on **OK**.

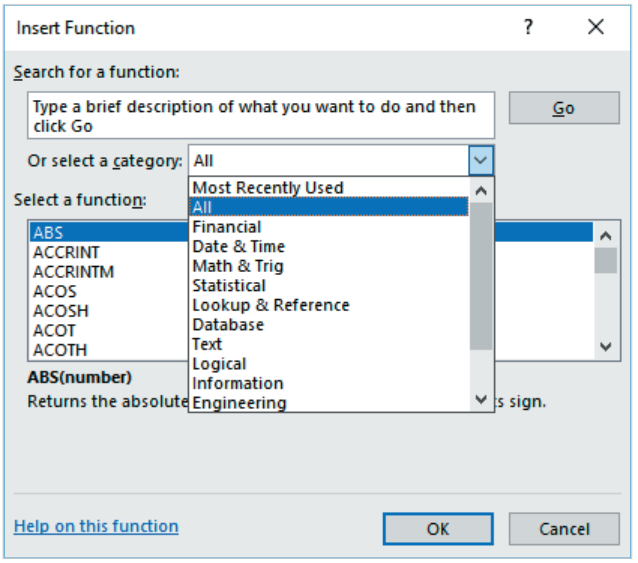


Fig. 5.33 Insert Function dialogue box

Formula Errors

Ms Verma points out that while working with formulas, we may sometimes find that if a formula is incorrectly entered, Excel displays an error message.

'It shows a yellow sign in the cell,' she tells the class and then shows them why these errors occur.

Error	Reason
#####	This error occurs when a cell is not wide enough to show the values.
#NUM!	This error occurs when an incorrect argument is specified in a formula.
#REF!	This error occurs when a reference given to a cell does not exist.
#DIV/0!	This error occurs when a formula divides a number by zero or an empty cell.
#NAME?	This error occurs when a formula is used incorrectly.
#N/A	This error occurs when a formula uses a value that does not exist.

Key Terms

String	A sequence of characters
Concatenation	The process of combining two or more strings
Formula	An expression that calculates the value of a range of cells
Function	A predefined formula that performs a specific operation

Recap

- A formula is an expression that consists of constants, cell references, operators, and functions.
- A formula always begins with an equals '=' sign.
- A cell reference is the address of a cell. There are three types of cell references—relative, absolute, and mixed.
- When a formula in a cell refers to its own cell value, a circular reference occurs.
- Functions are the built-in formulas that can be used directly to perform the calculation.
- You can also insert a function using the Insert Function button on the Formula bar.
- Excel displays an error when a formula or its arguments are incorrectly entered.

Exercise

A. Choose the correct options.

1. Which type of reference is represented by the formula '=A1 + A2'?
   a) Circular b) Relative c) Absolute d) Mixed
2. Which function returns the remainder when a number is divided by the divisor?
   a) FLOOR b) MOD c) POWER d) ROUND
3. Which symbol is used for string concatenation?
   a) @ b) ^ c) & d) $
4. Which function rounds the number to the nearest specified multiple?
   a) FLOOR b) MOD c) POWER d) ROUND
5. Which error occurs when a formula is incorrectly used?
   a) #NAME? b) #REF! c) # N/A d) #NUM!
6. Which formula is correct to calculate the average of the values from cells R6 to R19?
   a) = AVERAGE(R6:R19) b) = AVG (R6:R19)
   c) = AVGE(R6:R19) d) = AVRGE(R6:R19)

B. State *true* or *false*.

1. Functions are predefined formulas in Excel.
2. A function name can be written in upper case or lower case.
3. The total() function is used to find the sum of a set of values.
4. In absolute referencing, the '%' symbol is used before the cell numbers.
5. The count() function is used to find the total number of cells.
6. The #NUM! error occurs when an incorrect argument is specified in a formula.
7. The MAX() function is used to find the largest value from a set of given values.

C. Fill in the blanks.

1. The _____ sign is used to mark the beginning of a function.
2. When a formula refers to its own cell value, it is called _____ reference.
3. The values that a function uses are called _____.
4. When a cell address does not change on copying a formula, it is called _____ reference.
5. The _____ function returns the square root of a number.

D. Answer the following questions.

1. What is a cell reference? What are its types?
2. What are functions? Explain with examples.
3. How will you find the LCM of four numbers using a function?
4. Explain mixed reference with an example.
5. When do the following errors occur?
   a) #Ref!
   b) #Div/0
6. What does the function '=Text(Today(),"MMMM")' do?

Application-based Questions

1. Kanika wanted to convert the Indian Rupee (INR) to the United States Dollar (USD). She wanted to do this by creating a formula in Excel. Can you help her in doing so? Also complete the table given below.
   [Hint: 1 INR=0.015 USD]

	A	B
1	INR	USD
2	125	
3	35	
4	47	
5	39	
6	65	
7	25	

2. Given below is an incomplete worksheet that contains the length, width, perimeter, and area of five rectangles. Use appropriate formulas to fill in the missing cells.

	A	B	C	D
1	Length (in cm)	Width (in cm)	Perimeter (in cm)	Area (in cm^2)
2		3	16	15
3	2.5	3.1	11.2	
4	21		110	714
5	4.9	5	19.8	
6	6.1	2.3		14.03

3. Look at the given worksheet,and answer the following questions by using suitable formulas in Excel.

	A	B	C
1	Name	Matches Palyed	Average Score
2	Sunil	5	50.5
3	Ashish	6	40
4	Rohan	3	32
5	Sumeet	4	56
6	Rahul	8	78.9
7	Himanshu	7	45.5

a) Who played the maximum and minimum number of matches?
b) Find the total average score of the team.
c) Find the total number of matches played by all the candidates.

4. Look at the given worksheet, and observe the formulas used in the cells. Write the output of the cells from B2 to B5.

	A	B
1	Number	Formula
2	401.901	=FLOOR(A2, 2)
3	25	=MOD(A3, 5)
4	374.298	=ROUND(A4, 2)
5	78.6	=INT(A5)

Lab Activity

1. Your mathematics teacher has given you an assignment. Complete the assignment using suitable functions in Excel.
   a) Find the LCM of 11 and 99.
   b) Calculate the square of 165.
   c) Calculate the area of a square park whose perimeter is 120 cm.
2. Create a spreadsheet showing information about at least five students of your class and their marks in three subjects. Find the average marks of each student, and calculate the percentage achieved.

3. Nidhi wants to create a worksheet and present the following data in Excel. Help her in completing the task.
   a) Display the current day and date.
   b) Find the square roots of the numbers 1521, 1600, and 529.
4. Ketan is the owner of a furniture shop. He wants to calculate the final price (total + sales tax) of all the items in his shop. The chair is priced at ₹ 400, table at ₹ 500, bed at ₹ 1000, and wardrobe at ₹ 2000. There are ten tables, twelve chairs, five beds, and seven wardrobes available in his shop. The sales tax to be imposed is 9%. Can you help Ketan calculate the final price of all items?

Project

1. Collect data on normal and actual rainfall received by any ten states of India in the year 2017. Create a worksheet for the same. Compare the normal and actual values, and find the differences between the two.
2. Create an Excel worksheet on the monthly expenditure of your family. Collect data for any five months and do the following:
   a) Find the month in which the monthly expenditure was maximum.
   b) Find the total expenditure of all the five months.
   c) Represent the data by creating a column chart.

Explore More

- Find out the different categories of functions available in Excel. Make a list of all the common functions.
- Find out the different ways to correct and rectify errors that occur in Excel.

Weblinks

- https://www.excel-easy.com/introduction/formulas-functions.html
- https://www.techonthenet.com/excel/formulas/index.php

Notes for the Teacher

- Explain the different types of cell references with appropriate examples.
- Explain the use and importance of formulas and functions in Excel.
- Discuss the errors that can occur while using formulas and functions in Excel and ways to avoid and correct them.

6 Learning HTML5 and CSS

After going through this chapter, you will be able to—

- **write** an HTML program;
- **create** and **save** an HTML document; and
- **use** cascading style sheets (CSS) in HTML.

Nishtha learnt in class 6 that there is a computer language, known as hypertext markup language (HTML), that is used to create documents of the Web. All the web browsers are designed to understand and interpret this language.

She is curious to know how it is used in creating web pages. During the summer vacation, she went to her uncle Mr Prasad's place in Mumbai, who is a computer programmer.

'Who can be better than uncle to teach me HTML?' she asks herself.

On one Sunday, she requests her uncle. Mr Prasad is happy to teach Nishtha all about HTML.

History of HTML

Mr Prasad first gives a brief account of how HTML came into being.

'HTML has been derived from SGML, which stands for standard general markup language. HTML was created to allow those users who were not specialized in using SGML to create web pages. Tim Berners-Lee, an English engineer and computer scientist, proposed and created a prototype software called ENQUIRE in 1980. It was a system for the researchers at the European Organization for Nuclear Research (CERN) to use and share documents on the internet. In 1989, Tim invented the World Wide Web. He created the specifications for HTML and wrote the server and browser software in 1990.'

Tools Used to Write HTML Program

'Let me now tell you how an HTML program is written. There are two tools required for working on an HTML document—an HTML editor and a web browser,' Mr Prasad tells Nishtha.

HTML Editor

Mr Prasad now explains that an HTML editor is an application software program that allows users to create and write HTML codes. There are two types of HTML editors—a WYSIWYG editor and a text editor.

WYSIWYG editor: The term 'WYSIWYG' stands for 'What You See Is What You Get'.

Nishtha wants to know why it is called so. Mr Prasad explains that while using WYSIWYG, a programmer can see the end results of what is being created and can also edit the web pages being designed. It allows users to create web pages without having to write HTML code and provides a graphical interface. He gave some examples of WYSIWYG editors—Adobe Dreamweaver, Google Web Designer, Kompozer, and Amaya.

Text editor: A Text editor is a plain text editor like Notepad, which requires users to have an extensive knowledge of HTML programming. He gives WordPad and TextEdit as some examples of text editors.

Web Browser

'Now, you need a user interface that can interpret your HTML program and that user interface is provided by web browsers,' Mr Prasad tells Nishtha. He further adds that a web browser interprets the elements of an HTML document and creates an interactive document that we see as a web page. A collection of web pages usually interlinked to each other in various ways makes a website.

He lists some examples of web browsers—Google Chrome, Microsoft Edge, Mozilla Firefox, Apple Safari, and Internet Explorer.

Creating an HTML Document

'We will now learn how to create web pages,' Mr Prasad tells Nishtha. Nishtha is excited to learn the steps to create a web page.

Mr Prasad tells her that that he will use Notepad text editor in all these examples.

He shows her the steps to create an HTML document.

- He clicks on the **Start button > Windows Accessories > Notepad**.
- The **Notepad** window appears on the screen.
- He types a simple HTML code as shown in the image given below.

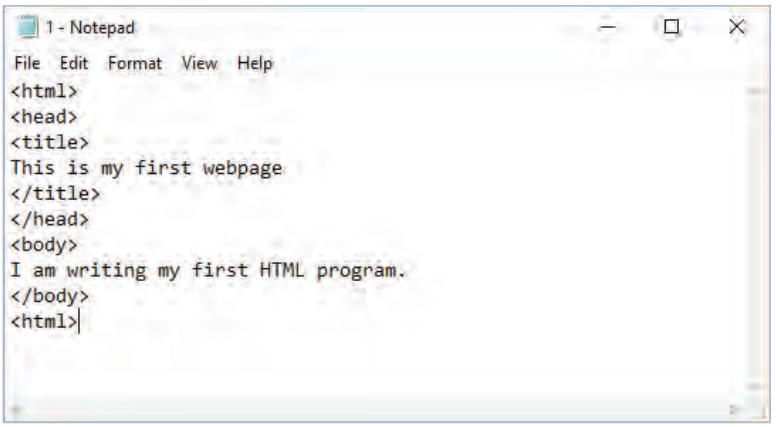


Fig. 6.1 Writing an HTML program

- He clicks on the **File** menu and selects the **Save** option. The **Save As** dialogue box opens up. He chooses the desired location to save the document.
- He then types in a desired name for the file with an extension '.html' and clicks on the **Save** button.

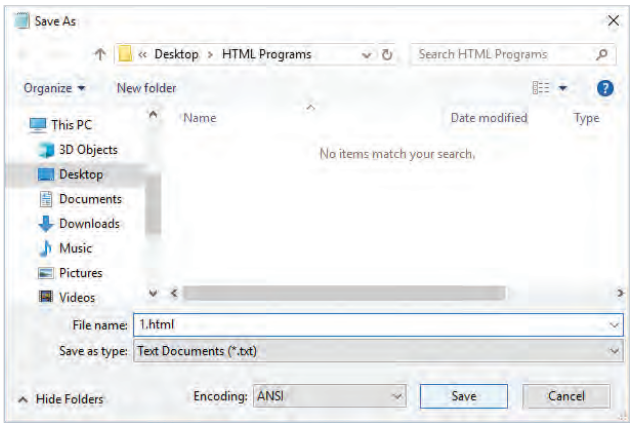


Fig. 6.2 Saving an HTML program

'The file is saved now,' he tells Nishtha.

Viewing an HTML Document

'How can I view the file?' Nishtha asks Mr Prasad.

'Just double-click on that file. The default browser will display the HTML document,' he informs Nishtha.

Mr Prasad also tells Nishtha about an alternative method.

'Open the Google Chrome browser. Press Ctrl + O on your keyboard. The **Open** dialogue box appears. Navigate to the file you want to open and click on **Open**.'

Components of HTML

Mr Prasad now explains the three main components of an HTML code—tags, elements, and attributes.

Tags

A tag is the basic component of an HTML document. Tags are used to define how a web page will format the content and display it. They do not appear in the browser window, but only affect the display of the content.

Quick Tip

Notepad, by default, saves the file with a '.txt' extension. You need to save an HTML document with a '.html' extension.

Did You Know?

When an HTML document is passed to a web browser, the browser interprets the mark-up language to an interactive document. This process is known as rendering.

Quick Tip

If you make any change in an HTML document after viewing it in a web browser, press the F5 key while viewing the page in the browser. It will refresh the document and reflect the recently made changes.

Remember

The tag <html> is also known as the outermost tag.

Mr Prasad tells Nishtha to remember that an HTML tag begins with a 'less than' symbol (<) and ends with a 'greater than' symbol (>). These symbols are also called angle brackets. For example, the first tag used in an HTML document is <html>, which defines that the document is an HTML document.

Syntax: <html> text </html>

Start tag End tag

'Look at this statement,' Mr Prasad says and explains.

'The part —<html> is called the opening tag, while the part—</html> is called the closing tag. The closing tag is the same as the opening tag except that it has a forward slash before its name.'

Elements

Mr Prasad next moves on to HTML elements. He explains to Nishtha that an HTML element comprises a start tag, an end tag, and the content inserted in between the tags. He gives an example:

```
<u> Text to be formatted </u>
```

'That means everything from a start tag to an end tag is an HTML element,' Nishtha responds.

Remember

In HTML, everything from a start tag to an end tag is an element.

Mr Prasad explains to Nishtha that some elements have only the start tag and are thus called **empty elements**. The elements that contain both start and end tags are called **container elements**. He mentions that the element '<u> Text to be formatted </u>' is a container element, while the <br> tag, which is used to display the text following it in a new line, is an empty element.

Attributes

Nishtha has learnt about the two components, tags and elements, of HTML. Next, Mr Prasad introduces her to the third component—attribute. An attribute provides additional information about an element. He tells Nishtha that all HTML elements can have their own attributes, which are always placed in the start tag.

'Attributes are usually defined in name-value pairs. The **name** is the property of the tag that you want to set, while the **value** is the value of the property to be set,' Mr Prasad explains further.

'Let me show you some key attributes with the help of an example,' he continues. The <p> tag, also known as the paragraph tag, is used to define a paragraph. Now we can use the attribute **align** with it to set the alignment of the paragraph. Also there are three possible values of the align attribute—left, right, and center. The structure of the <p> tag is then as follows:

```
<p align = "left"> This text is left aligned </p>
```

Rules for Writing an HTML Program

'What are the important points that I need to take care of while writing an HTML program?' Nishtha asks Mr Prasad. He then lists some important rules for writing an HTML program.

- The names of HTML tags and attributes are case-insensitive, which means that writing `<head>` and `<HEAD>` would have the same meaning.
- Container tags must always be closed.
- Attribute values must be enclosed within single or double quotes.
- Tag names should not have spaces. For example, `<head>` cannot be written as `<h e a d>`.
- There should not be any space between < and > in a tag.
- When two or more elements are nested, you first need to close the inner tag before closing the outer tag.

```
<p><b> this is a paragraph </b></p>        correct

<p><b> this is a paragraph </p></b>        incorrect
```

Structure of an HTML Document

Lastly, Mr Prasad tells Nishtha about the structure of an HTML document. He explains that it has two main components—HEAD and BODY.

1. The **HEAD** section contains the title and the other information about the HTML document.
2. The **BODY** section contains all the information that is displayed on a web page.

He then types the basic structure of an HTML document for Nishtha and explains each element to her.

```
<!DOCTYPE html>
<html>
<head>
<title>.......</title>
</head>
<body>
.....................
.....................
</body>|
</html>
```

Fig. 6.3 Structure of an HTML program

<!DOCTYPE html> element: This element is an empty element. It specifies that the following document is an HTML document.

<html> element: This is a container element. It contains the complete HTML document. The <head> and <body> tags are enclosed within the <html> tag.

<title> element: This is a container element that contains the title of a web page. This title is displayed on the title bar of the browser window.

Checkpoint

Answer the following questions.

1. What is HTML?
2. What are tags in HTML?
3. What is the difference between the <body> and <head> tags?
4. How are attributes defined?

Basic HTML Tags

'Let me now tell you about some of the elementary tags in HTML,' Mr Prasad tells Nishtha.

Heading Tag

The heading tag defines the heading levels in an HTML document. There are six heading levels defined by the elements—`<h1>`, `<h2>`, `<h3>`, `<h4>`, `<h5>`, and `<h6>`. The heading level `<h1>` is largest, while the `<h6>` level is smallest.

He then writes a program to display all the heading levels.

Did You Know?

Web browsers automatically add a white space before and after the heading level on the web page.

```
<!DOCTYPE html>
<html>
<head>
<title> Using the heading styles </title>
</head>
<body>
<h1>This is Heading 1</h1>
<h2>This is Heading 2</h2>
<h3>This is Heading 3</h3>
<h4>This is Heading 4</h4>
<h5>This is Heading 5</h5>
<h6>This is Heading 6</h6>
</body>
</html>
```

Fig. 6.4 Using heading tags

Paragraph Element

The paragraph element is used to define a paragraph in a web page. It begins with a `<p>` tag and ends with the `</p>` tag. The web browser automatically adds one line between two paragraphs.

Horizontal Rule

The horizontal rule element is used to draw a horizontal line on a web page. It is an empty element and begins with the `<hr>` tag.

Bold

The bold element is used to make the text appear bold. It is a container element. It begins with the `<b>` tag followed by the text to be formatted and ends with the `</b>` tag. For example,

```
<b> This text is bold </b>
```

Italics

The italics element makes the text appear in italics. It begins with the `<i>` tag and ends with the `</i>` tag.

For example,

```
<i> This text will appear in italics
style </i>
```

Quick Learn

What will be the output of the following code?

```
<b><i>I am learning to
write HTML code.</b></i>
```

Underline

The underline element underlines the text. It begins with the `<u>` tag and ends with the `</u>` tag.

For example,

```
<u> This text will be underlined </u>
```

Cascading Style Sheets (CSS)

Mr Prasad tells Nishtha that while creating a web page, we need to control how its content will be displayed. He then explains to her that cascading style sheets (CSS) work with markup languages to control the way the content of a web page is displayed.

'It is a way of separating the content of a web page from its appearance,' he adds.

Mr Prasad also makes it clear to Nishtha that CSS is a tool to standardize a website and multiple files can use the same style sheet.

CSS Syntax

Nishtha wants to know how CSS works. Mr Prasad tells her that a CSS contains style rules that are interpreted by the browser and then applied to the corresponding element in an HTML document.

He explains the three parts of a style rule:

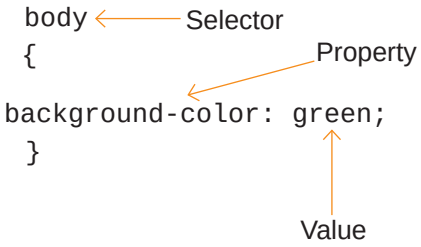
- **Selector:** It is the name of the HTML tag element to which a style is applied. For example, *h1*.
- **Property:** It is the type of an attribute of HTML tag. For example, *color* and *font size*.
- **Value:** It is the value of a property. For example, the *color* property can have values as *red*, *green*, or *blue*.

'When the selector, property, and value combine, it makes a **rule**,' Mr Prasad tells Nishtha.

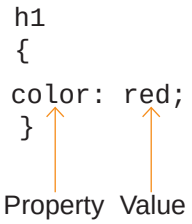
He writes the syntax of a rule for Nishtha:

```
Selector{property: value}
```

Mr Prasad helps Nishtha write a style rule:



This style rule will apply a background to a web page.



This rule will make all the H1 heading level content appear in red.

Applying CSS

Mr Prasad now explains the three methods of applying CSS in HTML—inline, internal, and external.

Inline CSS

The inline method uses the style attributes of an HTML element. They are written directly in the HTML document and affect only the tag they are applied to. Mr Prasad writes an example.

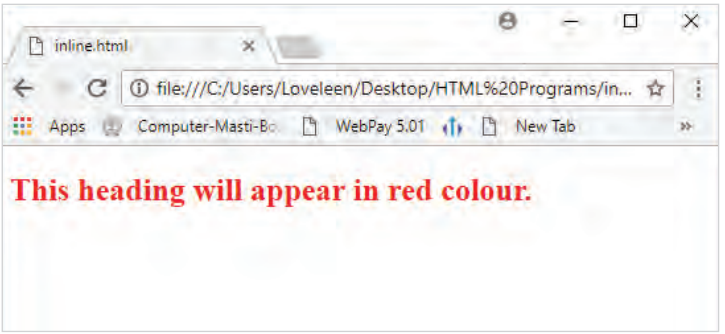


Fig. 6.5 Applying inline CSS

Example

```
<!DOCTYPE html>
<html>
<head>
<title> inline style sheet </title>
</head>
<body>
<h2 style="color:red;"> This heading will appear in red colour.</h2>
</body>
</html>
```

Internal CSS

'If you want to apply the style effect on a single HTML page, then use an internal style sheet,' Mr Prasad tells Nishtha. He also adds that it is defined in the <head> section of a HTML document within the <style> element and gives an example.

```
<!DOCTYPE html>
<html>
<head>
```

```
<style>
h2{color:red;}
</style>
</head>
<body>
<h2> This heading will appear in red colour.</h2>
<p> This is a new paragraph.</p>
</body>
</html>
```

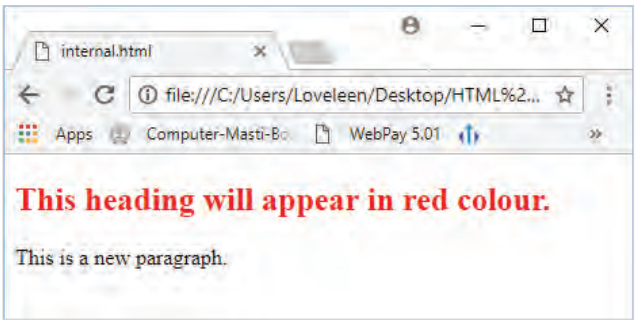


Fig. 6.6 Applying internal CSS

External CSS

Mr Prasad next tells Nishtha that we need an external CSS file to define style effects for multiple web pages and with it, we can change the entire look and feel of a website by changing just one file.

'To use an external CSS file, a link to the file is added to the <head> section of the HTML document,' he adds.

Example

```
<!DOCTYPE html>
<html>
<head>
<link rel="stylesheet" type="text/css" href="1.css">
</head>
<body>
<h1>This is a heading.</h1>
</body>
</html>
```

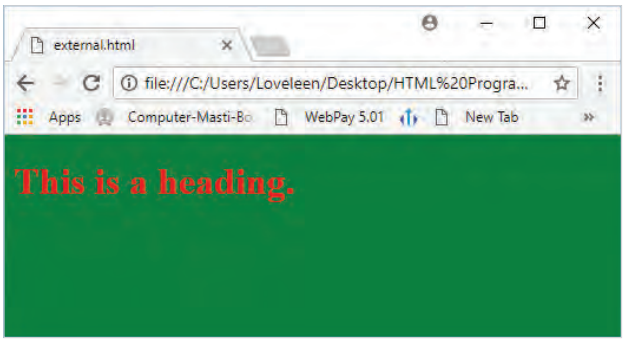


Fig. 6.7 Applying external CSS

'Let's discuss the components of the external CSS link,' He continues. He tells Nishtha to remember the following:

- The HTML <link> element specifies relationships between the current document and an external resource. This element is most commonly used to link style sheets.
- The 'rel' component stands for 'relationship', and it is one of the key features of the <link> element. The value denotes how the item being linked to is related to the containing document.
- The 'type' component contains the type of the resource being linked.
- The 'href' component specifies the name of the CSS file being linked.

Checkpoint

Answer the following questions.

1. List the heading tags in HTML.
2. What is the use of the <hr> tag?
3. Define the inline method of applying CSS.
4. How is external CSS different from internal CSS method?

Background Properties in CSS

'I want to know more about setting the background colour,' Nishtha requests her uncle.

'We use CSS background properties for setting the background style,' Mr Prasad replies, and then he explains further.

Setting the Background Colour

Mr Prasad continues, 'As you can see, I am using the background-color property, which is used to specify the colour of the background. Nishtha wants to know its syntax. Mr Prasad writes it for her:

```
background-color:value
```

Here value is the colour name or its hexadecimal value.

'What do you mean by hexadecimal colour values?' asks Nishtha.

Mr Prasad explains that the hexadecimal colour value has a format—#RRGGBB, where RR specifies the red component, GG specifies the green component, and BB specifies the blue component of a colour. He tells Nishtha that the values of RR, GG, and BB must be between 0 and FF. For example,

```
color:00FFFF
```

'Let me show you an example, say, let's put a green background,' Mr Prasad explains and types the following code.

Quick Tip

If you don't know the value of a colour, one way is to use the online image colour picker to get the HTML colour code.

```
<!DOCTYPE html>
<html>
<head>
<style>
body
{
     background-color:green;
}
</style>
</head>
<body>
<p>This page has a green background colour.</p>
</body>
</html>
```

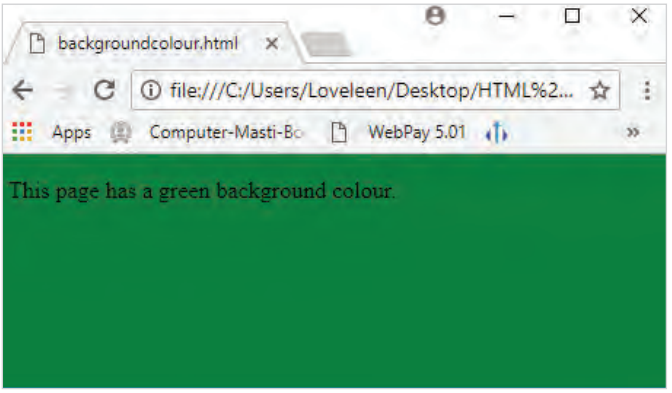


Fig. 6.8 Changing the background colour

Quick Learn

What will be the output of the given statements?

```
body
{
background-color:#0000ff
}
```

Setting the Background Image

Next Mr Prasad explains about the various properties associated with the background image of an HTML page to Nishtha with examples.

The background-image property

This property is used to set an image as a background image. The syntax of the background-image property is as follows:

```
background-image:url("path of the image")
```

Here URL is the path of the image where it is stored.

Example: `background-image:url("flower.jpg")`

Remember

To know the URL of an image, right-click on the image and select 'Properties' from the pop-up menu. Then click on the Security tab. The Object name is the URL of the image.

The background-repeat property

This property is used to specify whether the background image is to be repeated or not. The syntax is as follows:

```
background-repeat:value
```

Here value can be repeat|repeat-x|repeat-y|no-repeat

- **repeat:** It is the default value. It specifies that the image will be repeated in both directions.
- **repeat-x:** It specifies that the image will be repeated horizontally.
- **repeat-y:** It specifies that the image will be repeated vertically.
- **no-repeat :** It specifies that the image will not be repeated.

The background-attachment property

This property is used to specify whether a background image is fixed or scrolls with the page. The syntax is as follows:

```
background-attachment:value
```

Here value can be fixed|scroll.

- **fixed:** It specifies that the image will not scroll with the HTML page.
- **scroll:** It specifies that the image will scroll with the HTML page.

Quick Learn

Create a web page on 'Birds'. Place any image showing birds as a background image. The image should scroll while scrolling the HTML page.

The background-position property

This property is used to specify the position of the background image. The syntax is as follows:

```
background-position:value
```

Here value can be xpos ypos|x% y%|[top|bottom|center]|[left|center|right]

- **xpos ypos:** It specifies the horizontal and vertical positions respectively in units of length.
- **x% y%:** It specifies the horizontal and vertical positions respectively in percentage.
- **[top|bottom|center]|[left|center|right]:** These specify the values of the vertical and horizontal positions respectively. These values must be chosen in conjunction from both the sets.

Let us now write an HTML program to show the use of all the background-image properties.

Example:

```
<!DOCTYPE html>
<html>
<head>
<style>
body
{
background-image:url("flower.jpg");
background-repeat:repeat;
background-attachment:fixed;
background-position:top left;
background-image:300px 300px;
}
</style>
</head>
<body>
<p>This page shows a background image.</p>
</body>
</html>
```

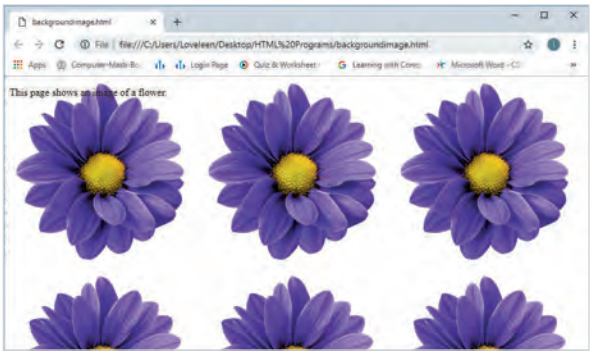


Fig. 6.9 Applying background-image properties

Now Nishtha has learnt how to create an HTML document and write an HTML program. Mr Prasad helps her practise more using CSS to set style effects in HTML documents.

Key Terms

HTML	A language that uses markup codes to create web pages
Tag	A keyword that defines how a web page will appear
Element	An HMTL component that contains a start tag, an end tag, and the content in between
Container element	An element that contains the start and end tags
Empty element	An element that contains only the start tag
Attribute	A characteristic of an HTML element that gives some extra information about it
Cascading style sheet (CSS)	A method of defining rules to control the display of the HTML elements

Recap

- HTML stands for hypertext markup language. It is a programming language that uses markup codes to create web pages.
- An HTML editor is required for creating and saving HTML documents. It can be a plain text editor or a WYSIWYG editor.
- A web browser is required to view HTML documents.
- An HTML code comprises tags, elements, and attributes.
- An HTML document is divided into two parts—Head and Body. The Head section contains the title, which appears in the title bar, and information about the HTML document.
  The Body section contains the other tags that are displayed on the web page.
- CSS stands for cascading style sheet. It is a style sheet that is used to add styles and effects to a web page.
- There are three ways of adding CSS to a web page—inline, internal, and external.
- Background properties of CSS are used to set the background style of an HTML element.

Exercise

A. Choose the correct options.

1. Which of the following is a valid tag in HTML?
   a) `<b>` b) `<e>` c) `<c>` d) `<f>`
2. Which of the following is an empty element?
   a) `<i>` b) `<br>` c) `<head>` d) `<body>`
3. Which of the following properties changes the colour of the background of an element?
   a) `color` b) `position` c) `attachment` d) `image`
4. Which of the following is a valid heading tag in HTML?
   a) `<h6>` b) `<h7>` c) `<h8>` d) `<h9>`
5. Which of the following is the correct way to embed CSS in an HTML document?
   a) Inline b) External c) Internal d) All of these
6. The _____ property helps us to scroll an image on an HTML page.
   a) `background-attachment` b) `background-position`
   c) `background-repeat` d) `background-image`

B. State *true* or *false*.

1. An HTML document starts with the `<html>` tag.
2. The internal CSS method adds a link to the CSS file in the `<head>` tag.
3. The `<u>` tag is used to underline the text.
4. The `<p>` tag is a container tag.
5. Tag names are case-insensitive.

C. Fill in the blanks.

1. The _____ property is used to handle the background in CSS.
2. The _____ element displays the text on a new line.
3. HTML documents are viewed using a _____.
4. The _____ elements contain only the start tags.
5. The _____ tag is used to make the text appear in italics.

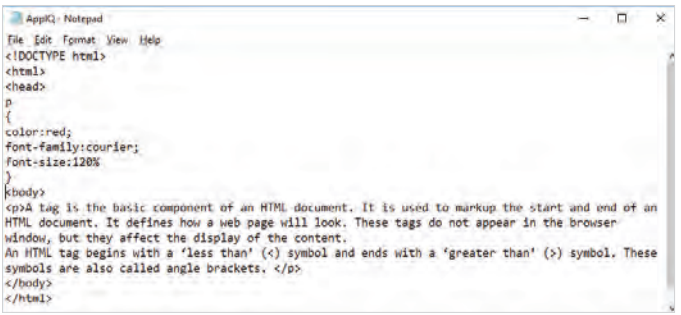
D. Answer the following questions.

1. Define HTML. What is its use?
2. What are HTML tools? Give examples.
3. Explain the structure of an HTML document.
4. What are the different methods of applying CSS?
5. List all the background properties of CSS and their uses.

Application-based Questions

1. Use the HTML heading tags to create the hierarchy given in the image below. Also, change the colour of these headings. Apply different colours to all headings.

2. Mira wants to change the style of all the paragraph elements used in an HTML document. She has written the code, but it is not working. Help her in finding the errors and correcting the code.



3. What is the advantage of CSS? When would you use it and how? How would you decide between using inline, internal, and external CSS?

Lab Activity

1. Create a web page on your favourite sport as directed below:
   a) Use Notepad to write the HTML code.
   b) Set the title as 'My Favourite Sport'.
   c) Write the name of your favourite sport as the biggest heading and underline it.
   d) Draw a horizontal line.

e) Write a paragraph giving a brief introduction of the sport. The paragraph should be in italics.
f) Write the next level of heading as 'Rules of the Game'.
g) Write the rules in separate lines.
h) Save the program as 'Favourite Sport', and view it in the browser.

2. Open the file 'Favourite Sport.html' and follow these instructions:
   a) Using the inline CSS, change the colour of the first heading to green.
   b) Change the colour of the second heading to blue.
   c) Save the file as 'Inline CSS.html', and view it in the browser.

3. Open the file 'Favourite Sport.html' and follow these instructions:
   a) Add second level of heading to it as 'Star Players'.
   b) Write the name of the top five players.
   c) Add another second level of heading as 'Championships'.
   d) Write the names of various national and international championships being organized.
   e) Using the internal CSS, change the colour of the first heading to red.
   f) Change the colour of the second heading to green.
   g) Now save the file as 'Internal CSS.html', and view it in the browser.

4. Type CSS code in a notepad file setting the colour of 'h1' heading as blue and that of 'h2' heading as red.
   a) Save the file as 'firststyle.css'.
   b) Open the file 'Favourite Sport.html'.
   c) Use the <link> element in the head tag to link to the external style sheet 'firststyle.css'.
   d) Save the file as 'External CSS.html', and view it in the browser.

5. Open the file 'firststyle.css'.
   a) Add code to change the background to pink.
   b) Save the file.
   c) View 'External CSS.html' in the browser.

6. Create an HTML document on 'monuments in India'. Now follow these instructions:
   a) Using an external stylesheet to add a collage of monuments as the background image.
   b) The image should be in the centre of the page and should be fixed.
   c) There should be only one copy of the image.
   d) Save the file as 'Monuments of India', and view it in the browser.

Project

Create a web page that displays information about your school. The heading should contain the name of your school. The background image should be one of your school's images. Show the names of the head girl and head boy of your school.

Explore More

- Find out about other formatting tags in HTML.
- Research on the new features of HTML 5.2, and compare them with the older version of HTML.

Weblinks

- https://www.w3schools.com/html/
- https://www.w3schools.com/css/

Work Wisely

- Artists often take care of differences in colour or brightness in their photographs and paintings. This is known as contrast and it creates a special effect. Always make use of light colours in your background if the text is dark and dark colours if the text is light. It helps the text to stand out from the background.
- Always try to use the external CSS method of applying CSS. It helps you to make changes to the entire website at once and keeps your HTML code clean.

Notes for the Teacher

- Demonstrate and give examples of creating HTML documents.
- Explain the tags and elements discussed in this chapter by giving suitable examples.
- Discuss the importance of CSS and demonstrate how to create external style sheets.

7 More on CSS

After going through this chapter, you will be able to—

- **list** the properties of text, font, margin, and border in cascading style sheets (CSS) and
- **make use of** these properties to create web pages.

In the previous chapter, you have seen how Nishtha learnt to create, save, and view an HTML document in a web browser from her uncle. She also learnt to enhance web pages using the cascading style sheets (CSS). In this chapter, we will see how Nishtha explores more on CSS to enhance her skills.

After summer vacations, Nishtha is feeling rejuvenated. She is happy as besides enjoying with her cousins and completing holiday homework, she has learnt one exciting thing—HTML. She is thankful to her uncle, Mr Prasad, who took time off to teach her this markup language. He has taught her enough on HTML to explore further and create web pages on her own.

Nishtha is sitting in her computer class. Her computer teacher, Ms Shalini Yadav, introduces the class to HTML. Nishtha is elated. She has reinforced her concepts on how to create HTML documents.

Today, Ms Yadav is going to teach the class how to use various properties in CSS and make their uses in creating web pages.

Text Properties

Ms Yadav starts with the text properties, which are used to format the text of HTML elements. She tells the class about various properties associated with the text.

Color

Ms Yadav writes the syntax of the color property:

```
color:value
```

She tells the class that here the value can be a colour name, a hexadecimal colour code, or an RGB colour code.

The colour name is a predefined name of the colour available. For example,

```
color:red
color:aqua
```

Ms Yadav explains to the class that the hexadecimal colour value has a format—#RRGGBB, where RR specifies the red component, GG specifies the green component, and BB specifies the blue component of a colour. The values of RR, GG, and BB must be between 0 and FF. For example,

```
color:00FFFF
```

The RGB colour code specifies the red, green, and blue components of a colour. The values of these components must be from 0 to 255 or a percentage value from 0% to 100%. For example,

```
color:rgb(1, 255, 255)
color:rgb(50%, 50%, 0%)
```

Ms Yadav then writes a sample code.

```
<style type="text/css">
p{color:blue}
h1{color:FF4500}
</style>
```

In this code, the text of the paragraph element will appear in blue, and the text of the heading level 1 will appear in orange.

Did You Know?

The hexadecimal value FF is equivalent to 255 in decimal.

Direction

Ms Yadav writes the syntax of the direction property:

```
direction:value
```

She tells the class that the value can be 'ltr' or 'rtl'.

She emphasizes these points:

- The value 'ltr' renders the text from left to right.
- The value 'rtl' renders the text from right to left.

Now she writes a sample code to set the direction property of the <h1> heading.

```
<style type="text/css">
h1{direction:rtl}
</style>
```

Text Align

Ms Yadav tells the class that the text-align property is used to set the horizontal alignment of the text and it is applied to a block of text. She asks Nishtha to write the syntax of the property:

```
text-align:value
```

Here the value can be left, right, center, or justify. She then asks Ravish to come forward and helps him write a sample code that sets the text-align property of different elements of HTML.

```
<style type="text/css">
h1{text-align:left}
h2{text-align:right}
h3{text-align:center}
p{text-align:justify}
</style>
```

Text Decoration

Ms Shalini writes the syntax of the text-decoration property and tells the class that the value can be none, underline, overline, blink, or line-through.

```
text-decoration:value
```

This time Akriti writes a sample code that sets the text-decoration property of different elements.

```
<style type="text/css">
h1{text-decoration:underline}
h2{text-decoration:overline}
h3{text-decoration:line-through}
h4{text-decoration:blink}
</style>
```

Remember

'None' is the default text-decoration property.

Text Indent

'We use the text-indent property to indent the first line of the text in an HTML element,' Ms Shalini tells the class and writes the syntax of the property.

```
text-indent:value
```

She tells the class that the value can be a number in pixels or percentage and writes a sample code to use the text-indent value.

```
<style type="text/css">
h1{text-indent:100px}
p{text-indent:50%}
</style>
```

Quick Learn

Create a heading level 2 and do the following:

- Set the font colour to green.
- Underline the text.
- Set the alignment to right.

Letter Spacing

'Sometimes, we need to increase or decrease the blank space between the letters of a word in HTML. For this, we use the letter-spacing property,' Ms Yadav informs the class and tells the children that the value can be a number in pixels after writing the syntax:

```
letter-spacing:value
```

She invites Tandeep to write a sample code for setting the spacing between letters to five pixels.

```
<style type="text/css">
h1{letter-spacing:5px}
</style>
```

Word Spacing

'When do we use the word-spacing property in HTML?' Ms Yadav asks the class.

'It is used to increase or decrease the space between the words of a sentence,' answers Nishtha.

Ms Yadav appreciates Nishtha and tells the class that the value in the syntax can be a number in pixels.

```
word-spacing:value
```

Nishtha comes forward and writes a code for setting spacing between the words of the text of the heading level 1.

```
<style type="text/css">
h1{word-spacing:5px}
</style>
```

Ms Yadav goes on to explain other CSS text properties. For each property, she invites a child to come forward and write a sample code. She helps children write the codes.

Line Height

This property is used to specify the vertical space between two lines of the text.

Syntax: `line-height:value`

Possible values: numbers, percentages, lengths, or normal

Sample code:

```
<style type="text/css">
h1{line-height:10px}
h2{line-height:5cm}
h3{line-height:10%}
</style>
```

Note that 'normal' is the default value of the line-height property.

Text Transform

This property is used to specify the capitalization of the text.

Syntax: `text-transform:value`

Possible values:

- none—to keep the text as it is

- capitalize—to capitalize the first letter of each word
- uppercase—to convert all letters into upper case
- lowercase—to convert all letters into lower case

Sample code:

```
<style type="text/css">
h1{text-transform:uppercase}
p{text-transform:capitalize}
</style>
```

This code sets the text of the heading level 1 to upper case, and the first letter of each word of the text of the paragraph element will be capitalized.

Text Shadow

This property is used to set the shadow around the text.

Syntax: `text-shadow:h-shadow v-shadow color`

where

- 'h-shadow' specifies the distance of the horizontal shadow in pixels,
- 'v-shadow' specifies the distance of the vertical shadow in pixels, and
- 'color' specifies the colour of the shadow effect.

Sample code:

```
<style type="text/css">
h1{text-shadow:20px 10px green}
p{text-shadow:10px 5px yellow}
</style>
```

Note that this may not be supported by all the web browsers.

Now Ms Yadav explains to the class how to write programs using the text properties. Here is an example.

Quick Tip

To use the same property with different selectors, separate the selectors with comma. For example,

```
h1, h2, h3
{text-align:center}
```

Example 1: Program using the text properties

```
<html>
<head>
</head>
<style type="text/css">
h1{color:red; text-align:center; text-transform:uppercase; text-
decoration:underline; text-shadow:2px 2px yellow}
p{text-indent:100px}
```

```
</style>
<body>
<h1> The Earth </h1>
<p>The planet Earth on which we live is a huge ball revolving around
the sun. The Earth revolves at a rate of 1,08,000 kilometres per hour.
Scientists believe that millions of years ago our Earth was just a
huge cloud of dust and gases floating in space. Over a period of time,
the Earth cooled and hardened. The Earth's surface cooled and formed a
crust. But the inside of the Earth is still bubbling hot-molten metal.
Even today our planet is in the process of cooling. The Earth is not a
perfect sphere; it is slightly flattened at the poles and bulges at the
equator. It has a diameter of 12,000 kilometres at the equator. Scien-
tists believe that the Earth is about 5,500,000 years old. It is about
150 million kilometres from the Sun.</p>
</body>
</html>
```

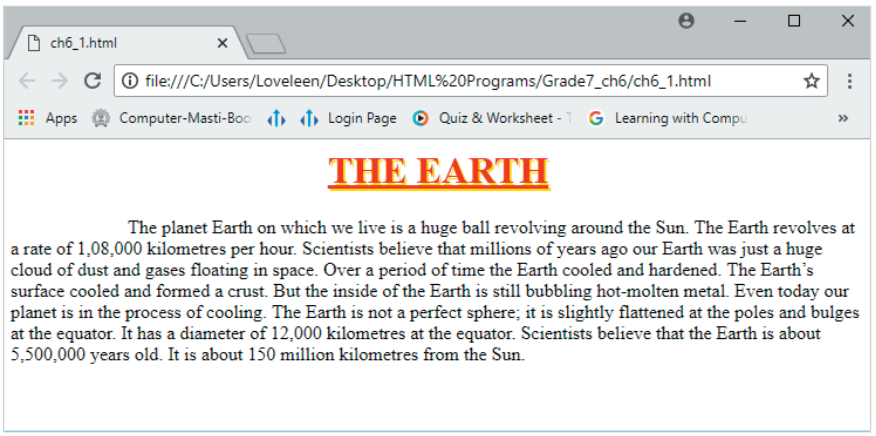

ch6_1.html
file:///C:/Users/Loveleen/Desktop/HTML%20Programs/Grade7_ch6/ch6_1.html
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Fig. 7.1 Output of Example 1

As the students are familiar with various text properties and they have practised quite a few programs using text properties, they can understand font properties with ease. Ms Yadav lists out the syntax and value of each font property.

Font Properties

The font properties are used to change the font type, font size, and font style.

Font Family

This property specifies a list of the font names for an element.

Syntax: `font-family:"value"`

Value: Font names separated by commas

Font Size

This property is used to set the size of the text.

Syntax: `font-size:value`

Possible values:

- xx-large
- x-large
- larger
- large
- medium
- percentage
- xx-small
- x-small
- smaller
- small
- value

Did You Know?

The default font size of the normal text is 16px.

Font Style

This property is used to specify the style of the font.

Syntax: `font-style:value`

Value: italics, oblique, and normal

Now Ms Yadav writes a program using the font properties. For better understanding, she uses the same text as used in the earlier program.

Example 2: Program to use the font properties

```
<html>
<head>
</head>
<style type="text/css">
h1{color:red; text-align:center; text-transform:uppercase; text-
decoration:underline; text-shadow:2px 2px yellow; font-family:arial;
font-size:50px}
p{text-indent:100px; font-family:times new roman}
</style>
<body>
<h1> The Earth </h1>
<p>The planet Earth on which we live is a huge ball revolving around
the Sun. The Earth revolves at a rate of 1,08,000 kilometres per hour.
Scientists believe that millions of years ago our Earth was just a
huge cloud of dust and gases floating in space. Over a period of time
the Earth cooled and hardened. The Earth's surface cooled and formed a
crust. But the inside of the Earth is still bubbling hot-molten metal.
Even today our planet is in the process of cooling. The Earth is not a
```

```
perfect sphere; it is slightly flattened at the poles and bulges at the
equator. It has a diameter of 12,000 kilometres at the equator. Scien-
tists believe that the Earth is about 5,500,000 years old. It is about
150 million kilometres from the Sun.</p>
</body>
</html>
```

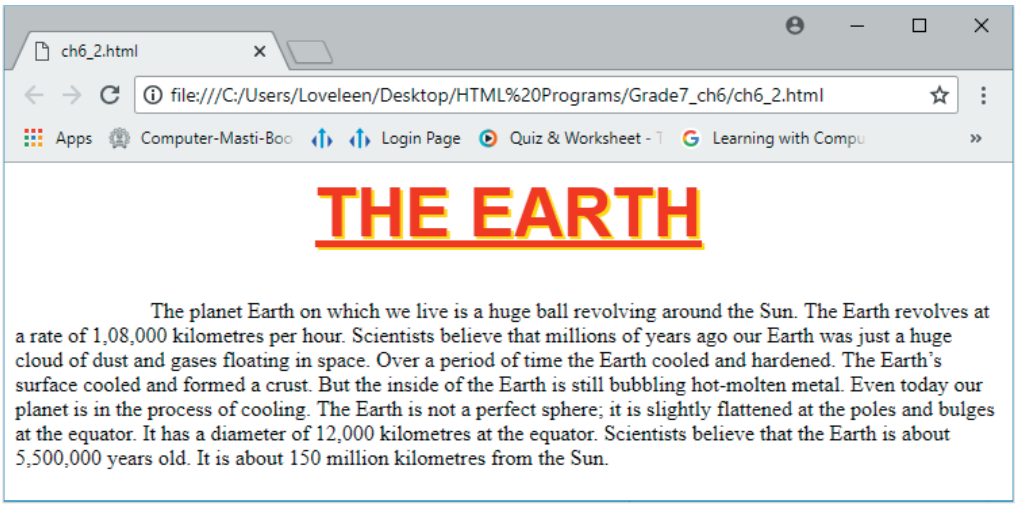
ch6_2.html
file:///C:/Users/Loveleen/Desktop/HTML%20Programs/Grade7_ch6/ch6_2.html
Apps
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Fig. 7.2 Output of Example 2

Font

Now Ms Yadav explains to the class how all the font properties can be set in one statement using the 'font' property.

She writes a sample code as follows:

```
<style type="text/css">
h1{font:oblique large times new roman}
</style>
```

She explains to the class that this code sets the font style to oblique, font size to large, and font type to Times New Roman of the text of the heading level 1.

Margin Properties

Now it's time to deal with margin properties. Ms Yadav tells the class that these are used to set the margins for an HTML document.

Margin Bottom

This property is used to set the bottom margin of an element.

Syntax: `margin-bottom:value`

Value: A number in pixels

Margin Top

This property is used to set the top margin of an element.

Syntax: `margin-top:value`

Value: A number in pixels

Margin Left

This property is used to set the left margin of an element.

Syntax: `margin-left:value`

Value: A number in pixels

Margin Right

This property is used to set the right margin of an element. The syntax of this property is as follows:

Syntax: `margin-right:value`

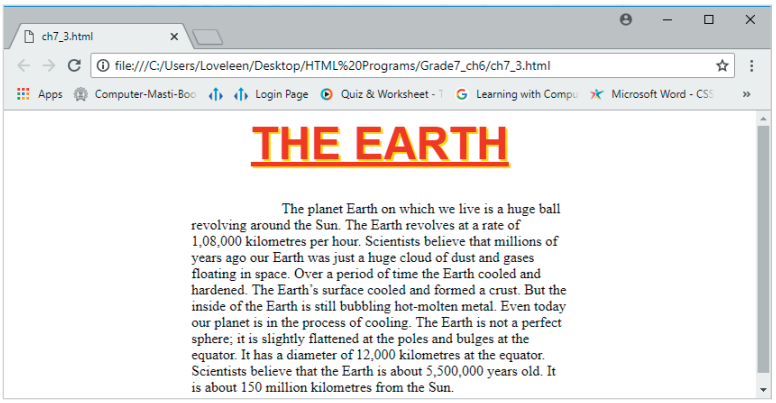
Value: A number in pixels

Now Ms Yadav invites Nishtha to come forward and write a program using the margin properties. The text used again remains the same, which help the children understand the changes done.

Example 3: Program to use the margin properties

```
<html>
<head>
</head>
<style type="text/css">
h1{color:red; text-align:center; text-transform:uppercase;
text-decoration:underline; text-shadow:2px 2px yellow;
font-family:arial; font-size:50px}
p{font-family:times new roman; margin-left:200px; margin-right:200px}
</style>
<body>
<h1> The Earth </h1>
<p>The planet Earth on which we live is a huge ball revolving around
the Sun. The Earth revolves at a rate of 1,08,000 kilometres per hour.
Scientists believe that millions of years ago our Earth was just a
huge cloud of dust and gases floating in space. Over a period of time
the Earth cooled and hardened. The Earth's surface cooled and formed a
crust. But the inside of the Earth is still bubbling hot-molten metal.
Even today our planet is in the process of cooling. The Earth is not a
perfect sphere; it is slightly flattened at the poles and bulges at the
```

```
equator. It has a diameter of 12,000 kilometres at the equator. Scien-
tists believe that the Earth is about 5,500,000 years old. It is about
150 million kilometres from the Sun.</p>
</body>
</html>
```


ch7_3.html
file:///C:/Users/Loveleen/Desktop/HTML%20Programs/Grade7_ch6/ch7_3.html
Apps
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Learning with Compu
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Fig. 7.3 Output of Example 3

Margin

Ms Yadav tells the class that just like the **font** property, the **margin** property specifies the margin for all the four sides—left, right, top, and bottom—in a single statement.

She writes a sample code setting the top margin to 100px, right margin to 200px, bottom margin to 100px, and left margin to 200px.

```
<style type="text/css">
h1{margin:100px 200px 100px 200px}
</style>
```

She tells the class to remember the following:

- If the margin property has only three values as given below:

  `margin:5px 10px 15px,`

  then the top margin is 5px; the right and left margins are 10 px; and the bottom margin is 15px.
- If the margin property has only two values as given below:

  `margin:5px 10px,`

  then the top and bottom margins are 5px and the right and left margins are 10px.
- If the margin property has only one value as given below:

  `margin:5px,`

  then all the four margins are 5px.

Quick Learn

What will happen if you specify negative values in the margin property as given below?

```
<style type="text/css">
h1{margin:-100px -200px
100px 200px}
</style>
```

Checkpoint

Choose the correct options.

1. Which of the following properties is used to render text from left to right?
   a) direction b) text-indent
   c) font d) text-transform
2. Which of the following is not a possible value of the text-align property?
   a) Center b) Middle
   c) Left d) Justify
3. Which of the following properties will you use to underline the text?
   a) direction b) text-indent
   c) font d) text-transform
4. Which of the following properties is used to specify the vertical space between two lines of text?
   a) word-spacing b) line-width
   c) line-height d) text-transform

Border Properties

Ms Shalini tells the class that the border properties provide a way to set the border width, border colour, and border style of an element in HTML.

Border Width

This property is used to set the thickness of the border of all the four sides.

Syntax: `border-width:value`

Possible values: thin, thick, medium, or a number in pixels

The default value is medium.

Border Color

This property is used to set the colour of the border.

Syntax: `border-color:value`

Value: A colour name or a hexadecimal colour code

Border Style

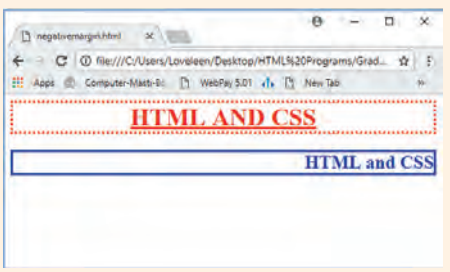
This property is used to set the style of the border.

Syntax: `border-style:value`

Value: dotted, dashed, solid, double, hidden, inset, outset, ridge, groove, or none.

Quick Learn

Write a program for the output shown in the image given below.



Excited with learning the use of various properties, the children are now able to write a program to use the border properties. One such program is given here.

Example 4: Program to use the border properties

```
<html>
<head>
</head>
<style type="text/css">
h1{color:red; text-align:center; text-transform:uppercase; text-decoration:underline; text-shadow:2px 2px yellow; font-family:arial; font-size:50px}
p{font-family:times new roman; text-align:justify; margin-left:200px; margin-right:200px; border-width:medium; border-color:blue; border-style:dashed}
</style>
<body>
<h1> The Earth </h1>
<p>The planet Earth on which we live is a huge ball revolving around the Sun. The Earth revolves at a rate of 1,08,000 kilometres per hour. Scientists believe that millions of years ago our Earth was just a huge cloud of dust and gases floating in space. Over a period of time the Earth cooled and hardened. The Earth's surface cooled and formed a crust. But the inside of the Earth is still bubbling hot-molten metal. Even today our planet is in the process of cooling. The Earth is not a perfect sphere; it is slightly flattened at the poles and bulges at the equator. It has a diameter of 12,000 kilometres at the equator. Scientists believe that the Earth is about 5,500,000 years old. It is about 150 million kilometres from the Sun.</p>
</body>
</html>
```

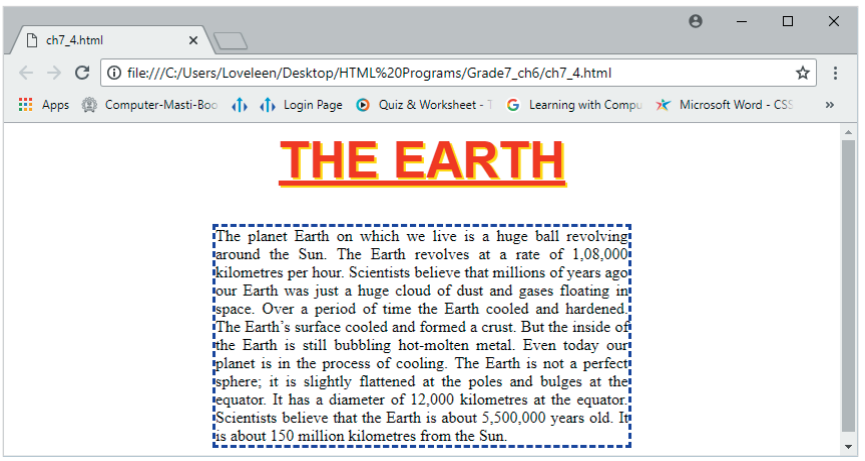

ch7_4.html
file:///C:/Users/Loveleen/Desktop/HTML%20Programs/Grade7_ch6/ch7_4.html
Apps
Login Page
Quiz & Worksheet -
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Fig. 7.4 Output of Example 4

Border

The children can easily come to the conclusion that the **border** property is used to set the border properties in a single statement. Arvind writes the syntax of the property:

```
border:border-width border-style border-color
```

Ms Yadav explains that if the value of the border-color is not specified, the colour applied to the border will be the colour of the text.

She then writes a sample code that specifies the border properties in one declaration.

```
<style type="text/css">
h1{border:100px dotted yellow}
</style>
```

Key Terms

Font	A set of letters, numbers, symbols of the same style
Margin	The space at the sides of a page
Border	A line around the edge of a text or graphic

Recap

- The color property is used to set the colour of the text.
- Text properties are used to format the text in a web page.
- Font properties provide the way to format the font.
- Margin properties are used to specify the margins around the text in a web page.
- Border properties are used to put the border, set the border colour, style and width of an HTML element.

Exercise

A. Choose the correct options.

1. Which of the following is the correct format of a hexadecimal value?
   a) RRGGBB b) GGRRBB c) BBGGRR d) RRBBGG
2. Which of the following values is valid for the direction property?
   a) trl b) rtl c) tlr d) rlt
3. Which property is used to underline a text?
   a) `text-direction` b) `text-indent`
   c) `text-decoration` d) `text-align`
4. Which of the following properties cannot be assigned to the text-transform property?
   a) `text-transform:no value` b) `text-transfrom:none`
   c) `text-transform:capitalize` d) `text-transform:uppercase`
5. Which property lets you specify the space between the lines of a text?
   a) `line-space` b) `line-height` c) `word-height` d) `font-height`

B. State *true* or *false*.

1. The RGB values must be from 0 to 255.
2. The default value of the text-direction property is 'ltr'.
3. The `font-size` property can have only three values—small, medium, and large.
4. The `border-color` property cannot have a value 'medium'.
5. The default value of the font colour is 'white'.

C. Fill in the blanks.

1. The _____ property is used to set the colour of the text.
2. The _____ property increases the space between the words of the sentence.
3. _____ displays the text in the cursive form.
4. The _____ property is used to display the text in lower case.
5. The hexadecimal values must be from _____ to _____.

D. Answer the following questions.

1. Mention three ways to assign the values to the color property.
2. What is the difference between the `letter-spacing` and `word-spacing` properties?
3. How is the `text-decoration` property different from the `text-align` property?
4. Explain the use of the `margin` property.
5. How can you change the font and font style of text?

Application-based Questions

1. Raghini wants to apply a shadow effect to all the second-level headings. Which property should she use? Write the code.

2. What will be the output of the following code?

```
<style type="text/css">
p{margin:200px 200px 100px 200px}
</style>
```

   What are the values of the top, bottom, left, and right margins?

3. Consider the code given below and answer the questions.

```
<style type="text/css">
p{text-decoration:underline; color:red; border:100px}
</style>
```

   a) Identify the errors in the code and write the code again.
   b) How will you change the font size? Write the statement in the above code.

Lab Activity

1. Create a web page on your favourite fruit.
   a) Add a background colour.
   b) Add relevant images of your favourite fruit.
   c) Add a heading describing the name of your favourite fruit.
   d) Add a paragraph showing the description of your favourite fruit.

2. Write a program in HTML to display a page on cybersecurity and proper precautions using the following descriptions:
   a) The heading level 1 should be capitalized and set in red with a shadow effect of 10px in yellow.
   b) The vertical distance between the lines of the text of the paragraph element should be 10 cm.
   c) Every paragraph element should be indented to 100px.

Project

You have ten items for children to sell. Create a web page showing all the items and their descriptions along with their prices. Use an appropriate background. Use a suitable font size and font colour. Also set borders, wherever possible. Add margins to enhance the web page.

Explore More

- What are some units (other than the pixel) used to measure the font size?
- Find out more about text and font properties in CSS.

Weblinks

- https://www.tutorialrepublic.com/css-tutorial/css-text.php
- https://developer.mozilla.org/en-US/docs/Learn/CSS/Styling_text/Fundamentals

Notes for the Teacher

- Demonstrate how to format the text, font, font size, margin, and borders in a web page.
- Explain how to use the same properties for different HTML elements.

8 Loops and Graphics in Python

After going through this chapter, you will be able to—

- **make use of** looping statements in Python and
- **draw** various shapes in Python.

In the previous class, Leena was introduced to a programming language. It was Python. It was fun for her and the entire class to learn about variables and data types, assigning values to variables, and statements in Python.

Today her computer teacher, Ms Vijayalakshmi Arora, is going to discuss some more statements in Python so that the children can explore more on Python.

The Input() Function

Ms Arora tells the class that the input() function is used to take an input from users. She tells the class to remember the following:

- This function stops the program execution and waits for the user to enter the data.
- A variable is required to store the input data.

She then writes the syntax of the input() function:

```
var=input("prompt string")
```

Then she writes some statements:

```
name=input("What is your name?")
print("My name is:", name)
```

She explains to the class that the first statement prompts us to enter our names and when a user enters the name, it is displayed on the screen.

Remember

- A decimal value in Python is known as a floating point. In other words, floating-point numbers have decimal points, for example 5.1.
- When an integer is multiplied by a floating-point number in Python, the result is a float-point number.

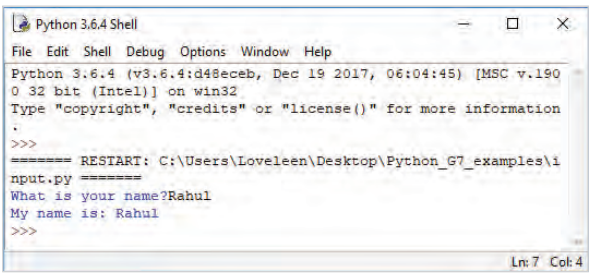
Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.190
0 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information
.
>>>
======= RESTART: C:\Users\Loveleen\Desktop\Python_G7_examples\i
nput.py =======
What is your name?Rahul
My name is: Rahul
>>>
Ln: 7 Col: 4

Fig. 8.1 Using input() statement

She writes the name and gets the output.

Ms Arora further explains to the class that the 'int' keyword used with the input statement, converts the value entered by a user to an integer value. She writes a program that calculates the area of the circle. She tells children that it will consider the value entered by the user as an integer value.

```
num=int(input("Enter the radius of the circle:\n"))
area=3.14*num*num
print("Area of the circle is", area)
```

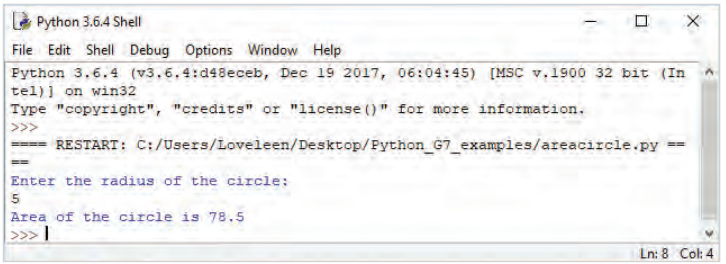
Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
==== RESTART: C:/Users/Loveleen/Desktop/Python_G7_examples/areacircle.py ====
Enter the radius of the circle:
5
Area of the circle is 78.5
>>>
Ln: 8 Col: 4

Fig. 8.2 Output of the above program

Ms Arora now writes a program and shows its output to children.

Example 1: To check whether the number entered by the user is even or not

```
num=int(input("Enter any number of your choice:"))
if (num%2)==0:
    print("The number is even.")
else:
    print("The number is odd.")
```

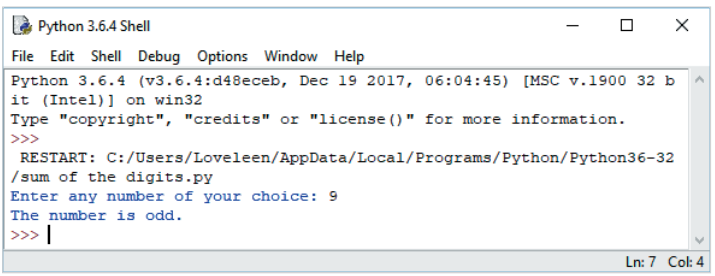
Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
RESTART: C:/Users/Loveleen/AppData/Local/Programs/Python/Python36-32/sum of the digits.py
Enter any number of your choice: 9
The number is odd.
>>>
Ln: 7 Col: 4

Fig. 8.3 Output of Example 1

Quick Tip

You can also use the float keyword with the input statement to accept floating-point values from a user.

Looping Statements

Ms Arora tells the class that the statements written in a program are executed one after another.

'But what will you do if you need to execute the same statement again and again?' she asks the class.

'In such a case, a looping statement is used,' she tells the class.

She further explains that a looping statement, or simply a loop, is used to execute a set of instructions multiple times. Then she discusses different types of looping statements.

While Loop

The 'while' loop iterates a block of statements as long as the given condition is true. When the condition becomes false, it stops the execution of the loop.

Syntax: while expression:
statements(s)

Ms Arora writes a program example that displays 'Hello' five times on the screen.

```
counter=1
while counter<=5:
    counter=counter+1
    print("Hello")
```

The output of this program is shown in Fig. 8.4.

Remember

The 'while' loop executes the block of statements till the condition remains true.

Quick Learn

Write a program to print first five multiples of 6.

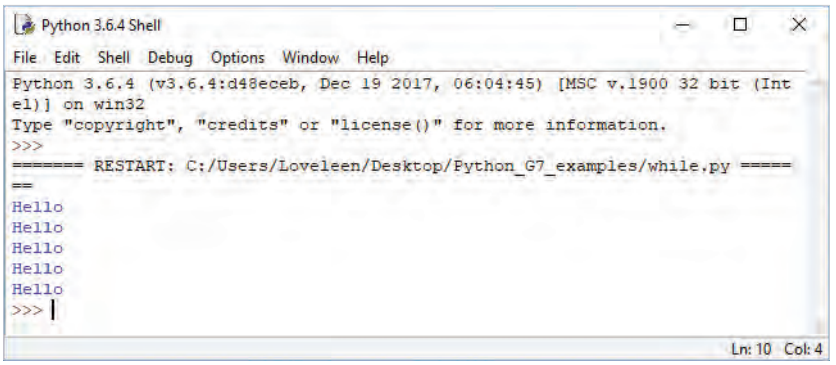

Fig. 8.4 Output of the 'while' loop

Let us now understand how the 'while' loop executes the program.

Step	Condition	Result	How does the loop work?
1	1 < = 5	True	The value of the counter is incremented by 1. The string 'Hello' is printed on the screen.
2	2 < = 5	True	The value of the counter is incremented by 1. The string 'Hello' is printed again on the screen.
3	3 < = 5	True	The value of the counter is incremented by 1. The string 'Hello' is printed again on the screen.
4	4 < = 5	True	The value of the counter is incremented by 1. The string 'Hello' is printed again on the screen.
5	5 < = 5	True	The value of the counter is incremented by 1. The string 'Hello' is printed again on the screen.
6	6 < = 5	False	The 'while' loop terminates.

Ms Arora now shows two more examples and encourages the class to practise more.

Example 2: To display all the natural numbers from 1 to 10

```
counter=0
while counter<10:
    counter=counter+1
    print(counter)
```

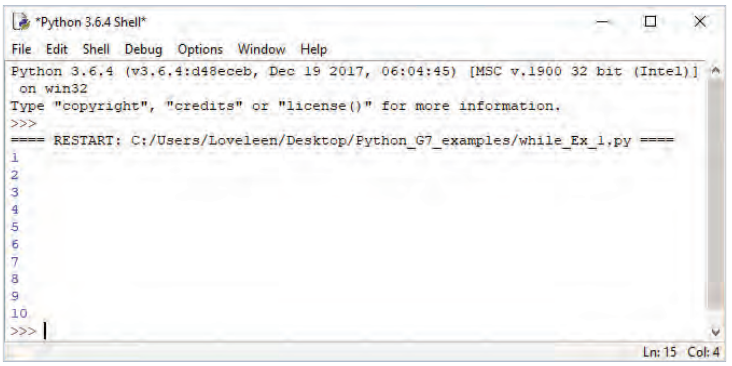

Fig. 8.5 Output of Example 2

Example 3: To print the sum of the digits of a number entered by a user

```
num=int(input("Enter a number:"))
snum=0
while num>0:
    rem=num%10
    snum=snum+rem
    num=int(num/10)
print("The sum of the digits is", snum)
```

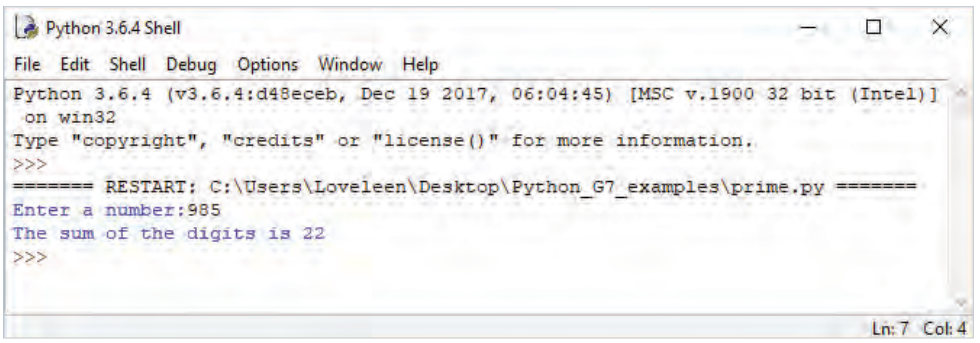
Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>>
======= RESTART: C:\Users\Loveleen\Desktop\Python_G7_examples\prime.py =======
Enter a number:985
The sum of the digits is 22
>>>
Ln: 7 Col: 4

Fig. 8.6 Output of Example 3

For Loop

Ms Arora tells the class that the 'for' loop is used to repeat the elements of a list. She writes the syntax of the 'for' loop:

```
for var in sequence:
    statement(s)
```

She then writes a code and explains it:

```
numbers = [1, 2, 3, 4, 5]
for i in numbers:
    print(i)
```

In this example, 'numbers' is a list of five numbers from 1 to 5. In the first iteration, the variable 'i' is assigned the first value in the list—that is, 1. Then the statements block is executed. Here the 'print(i)' statement is executed, which prints the value 1. Each item in the list is then assigned to the variable 'i' one by one until the entire list is exhausted.

Quick Learn

What will be the output of the following program?

```
names=["Rashmi", "Rohan", "Samara"]
for i in range names:
    print(i)
```

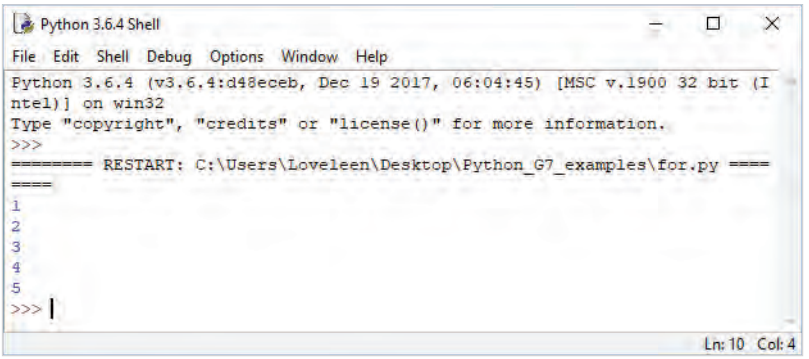

Fig. 8.7 Output of the 'for' loop

Using the range() Function

Ms Arora tells the class that sometimes we want to display a list of numbers within the specified lower and upper limits and in that case, the range function can be used. She writes an example:

```
for x in range(10, 20):
    print(x)
```

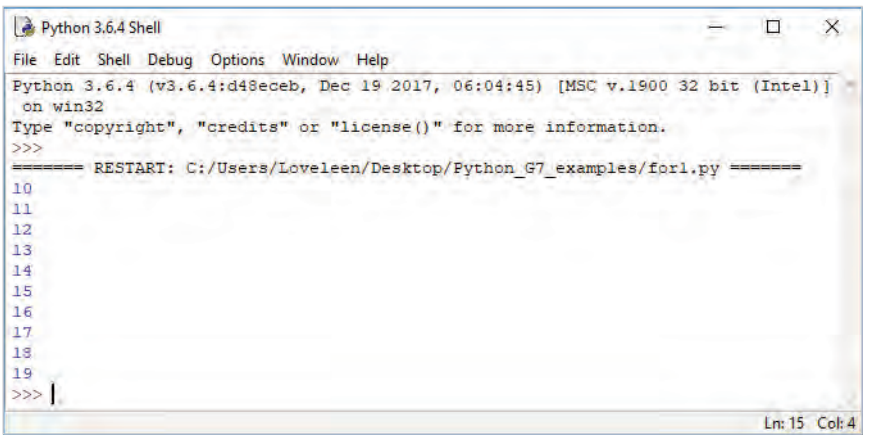

Fig. 8.8 Output of the given example

She explains that in this example, all the values starting from 10 till 19 are printed. Leena observes that the values are incremented by 1.

Then Ms Arora tells the children that to increment the values other than 1, we need to mention the step value in the range function along with the range values.

She writes the syntax of using the step value as:

```
for x in range(10, 20, 2):
```

She tells the class that here the variable '*x*' will be incremented by 2 numbers after every iteration.

Fig. 8.9 Output of the 'range()' function using the step value

Two examples are discussed to help the children understand better.

Example 4: To print the first ten numbers in the reverse order

```
for i in range(10, 0, -1)
    print(i)
```

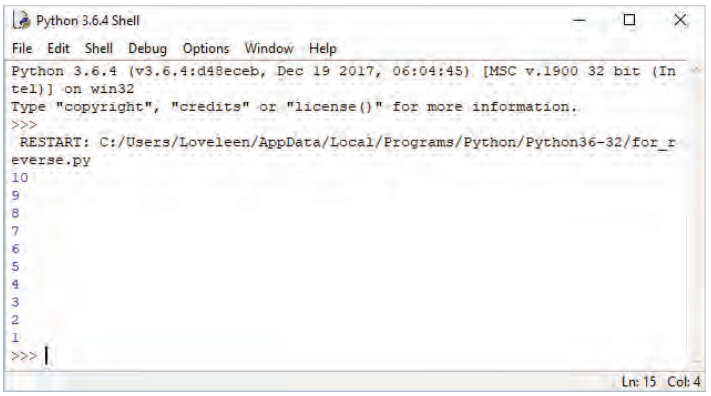

Fig. 8.10 Output of Example 4

Quick Learn

What will be the output of the following program?

```
for i in range(30, 20,
-10):
    print (i)
```

Example 5: To print the multiplication table of a number entered by a user

```
num=int(input("Enter the number for which you want to print the
table:"))
for i in range(1, 11):
```

```
print(num, “x”, i, “=”, num*i)
```

Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>>
======= RESTART: C:\Users\Loveleen\Desktop\Python_G7_examples\table.py =======
Enter the number for which you want to print the table:8
8 x 1 = 8
8 x 2 = 16
8 x 3 = 24
8 x 4 = 32
8 x 5 = 40
8 x 6 = 48
8 x 7 = 56
8 x 8 = 64
8 x 9 = 72
8 x 10 = 80
>>>
Ln: 16 Col: 4

Fig. 8.11 Output of Example 5

She now explains the break and continue statements and writes their syntaxes.

Break Statement

The break statement is used to get out of a loop forcefully. It ends the execution of the current loop and transfers the program control to the statement after the last statement of the loop.

Syntax:

```
if condition:
        break
```

A program using the ‘for’ loop and the break statement:

```
for x in range(5):
    if (x==2):
       break
    print(x)
print(“The program ends here.”)
```

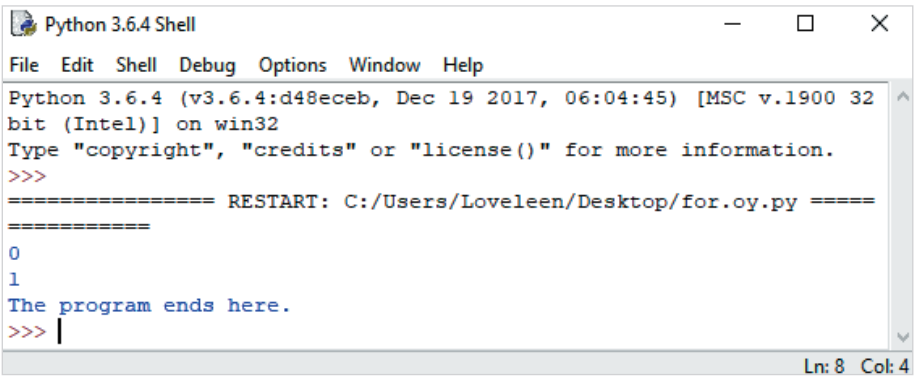
Python 3.6.4 Shell
File Edit Shell Debug Options Window Help
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/Loveleen/Desktop/for.oy.py ==========
0
1
The program ends here.
>>>
Ln: 8 Col: 4

Fig. 8.12 Output of the given program

Leena notices that in this program, when the value of *x* becomes equal to 2, the break statement is executed. The break statement skips the print statement and executes the next statement in the program.

Continue Statement

The continue statement takes the program control to the top of a loop and ignores the remaining statements in the loop.

Syntax of continue statement:

```
if condition:
    continue
```

A program using the continue statement:

```
for i in range(5):
    if (i==2):
        continue
    print(i)
```

Ms Arora tells the children that here when the value of i becomes 2, the program control will skip the print statement and will move to the first statement. The output of the program is shown in Fig. 8.13.

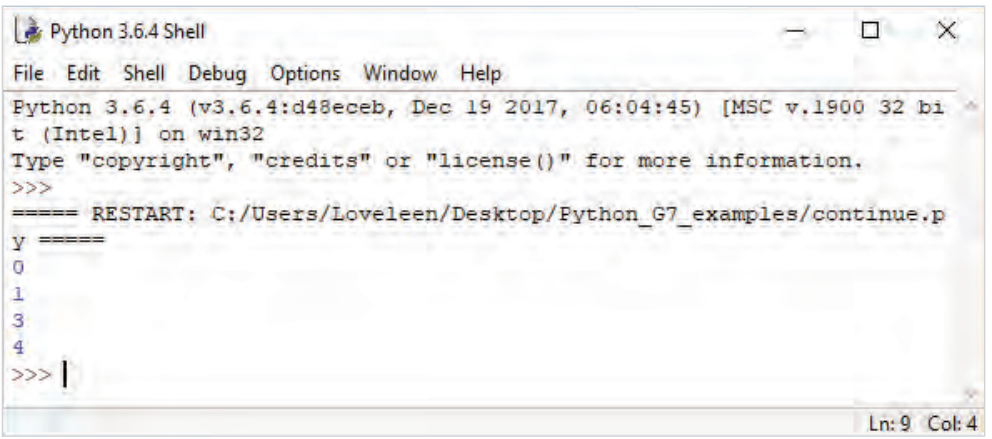

Fig. 8.13 Output of the given program

Errors in Python

'Have you observed how Python shows different error results for different mistakes?' asks Ms Arora.

She receives different responses from the class.

'I was writing a program to find the first five multiples of 7. When I ran the program, the Syntax Error dialogue box appeared,' says Akshat.

Ms Arora informs the class that the error that Akshat came across is known as the syntax error.

She further explains to the class about the different types of errors in detail.

Did You Know?

A loop can be put inside another loop. This is called nesting of loops. For example, a 'for' loop can be put inside a 'while' loop, or a 'for' loop can be put inside a 'for' loop.

Syntax Errors

While writing a program, we follow certain rules in using words and phrases. Syntax errors occur when these rules are not followed. These errors are similar to grammatical or spelling mistakes in a language, such as English. For example, the sentence

I going to play

is syntactically incorrect as a verb is missing here.

In Python, syntax errors occur due to the following:

- Missing parentheses, colon, or comma
- Incorrect indentation
- Making incorrect use of a keyword
- Empty block of statements

Runtime Errors

Sometimes, even when there is no syntax error in a program, it might not show any output. This is because of runtime errors. An error that occurs during the execution of the program is called a runtime error. When a program is stopped because of a runtime error, we say that the program has crashed.

Some points due to which a runtime error may occur are as follows:

- Accessing an element of a list which doesn't exist
- Making use of a variable which is not defined

Logical Errors

These errors occur when a program executes but does not produce the intended result. The error is caused due to the wrong logic used in the program. No explicit error is shown and thus you have to find the problem yourself and correct it.

Checkpoint

Answer the following questions.

1. How is a 'for' loop used?
2. What is the function of an input statement?
3. What is the difference between the break and continue statements?
4. What is a syntax error?

Graphics in Python

Now Ms Arora informs the class that Python allows us to draw shapes and fill colours in them. The class finds it interesting. She tells the class that though graphics are not a part of Python standard distribution package, we can start drawing graphics in Python by downloading a Python module (file) named 'graphics.py'. She tells the class to remember that this module must be saved in the location where your Python programs are saved.

Starting Graphics Window

To start the graphics window, Ms Arora opens IDLE, types the following code, and saves the program:

```
from graphics import*
win=GraphWin()
```

She tells the class that the first line of the code imports all the objects into the 'graphics.py' file and the GraphWin() function opens a separate graphics window as shown in Fig. 8.14.

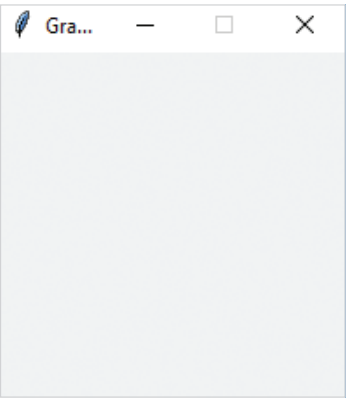

Fig. 8.14 Graphics window

She tells the class that the GraphWin() function must be stored in a variable. Here, the variable name is 'win'.

'Ma'am, what is a graphics window?' Leena asks.

Ms Arora then explains to the entire class, 'The graphics window is a small window that has a width of 200 pixels and height of 200 pixels. A pixel is a small square that is the smallest portion of an image displayed on the screen.'

She then writes a program to draw a pixel on the screen.

```
from graphics import*
window=GraphWin()
pt=Point(100, 50)
pt.draw(window)
```

The output is as shown in Fig. 8.15.

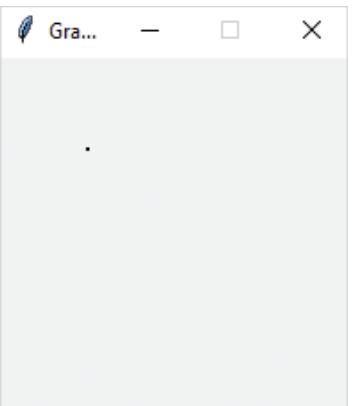

Fig. 8.15 Pixel on a graphics window

She explains the following to the class:

- In this program, the statement 'pt=Point(100, 50)' creates a pixel. It takes two values as its arguments, which represent the *x*- and *y*-coordinates respectively.
- The Point() function is stored in the variable 'pt'.
- The statement 'pt.draw(window)' is used to draw the object on the window. This statement will be used with every other object you create.

Functions in Graphics

Ms Arora now explains some functions (methods) available to draw shapes. Some of them are described below.

The Line() Function

- It is used to create a straight line between two points.
- It requires four parameters.

  Syntax: `Line(Point(x, y), Point (x,y))`
- The first two parameters are the *x*- and *y*- coordinates of one endpoint.
- The last two parameters are those of another endpoint.

Example 6: To draw a line

```
from graphics import*
window=GraphWin()
ALine=Line(Point(50, 100), Point(200, 100))
ALine.draw(window)
```

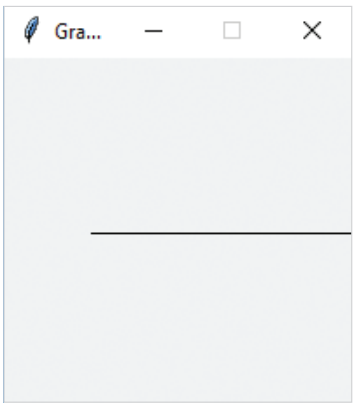

Fig. 8.16 Output of Example 6

Did You Know?

The setWidth(value) function is used to increase the thickness of the boundary line. For example, the statement `l=setWidth(5)` will increase the width of the line to five pixels.

The Circle() Function

- It is used to create a circle.
- It takes three parameters as its argument.

  Syntax: `Circle(Point(x, y), val)`
- The first two parameters are the *x*- and *y*-coordinates of the screen.
- The last parameter 'val' is the radius of the circle. It must be an integer value.

Example 7: To draw a circle

```
from graphics import*
window=GraphWin()
cir=Circle(Point(50, 100), 50)
cir.draw(window)
```

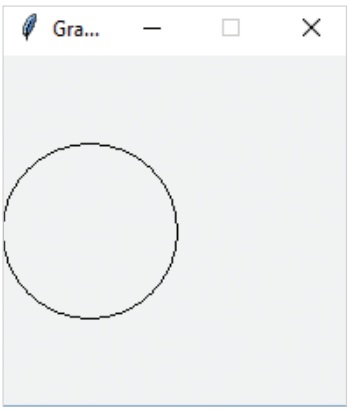

Fig. 8.17 Output of Example 7

The Rectangle() Function

- It is used to draw a rectangle.
- It takes four parameters.

  Syntax: `Rectangle(Point(x, y), Point (x, y))`
- The first two parameters represent the coordinates of the top-left corner of the rectangle.
- The last two parameters represent the coordinates of the bottom-right corner.

Example 8: To draw a rectangle

```
from graphics import*
window=GraphWin()
rect=Rectangle(Point(50, 40), Point(100, 150))
rect.draw(window)
```

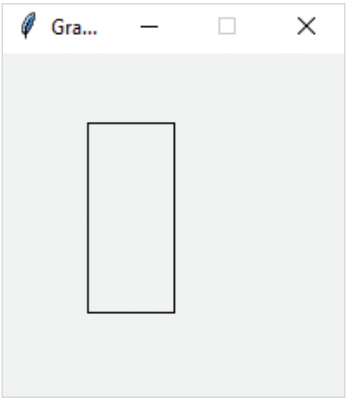

Fig. 8.18 Output of Example 8

The Polygon() Function

- It is used to draw a polygon.
- It takes six parameters.

  Syntax: Polygon(Point(30, 40), Point(60, 70), Point(80, 90))

Example 9: To draw a triangle using the Polygon() function

```
from graphics import*
window=GraphWin()
poly=Polygon(Point(30, 40), Point(100, 150),
Point(200, 90))
poly.draw(window)
```

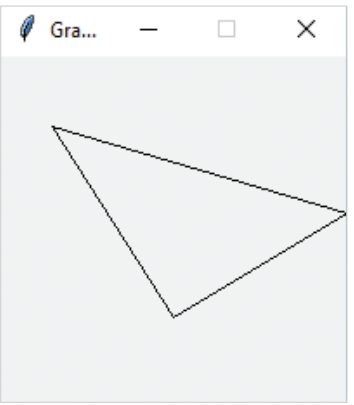

Fig. 8.19 Output of Example 9

The Text() Function

- It is used to add text to graphics.

  Syntax: Text(Point(x, y), "text_string")
- The first two parameters are the *x*- and *y*-coordinates at the centre of the text.
- The parament text_string is the text to be displayed on the screen.

Example 10: To add the text 'Hello World' to graphics

```
from graphics import*
window=GraphWin()
T=Text(Point(100,50),"Hello World")
T.draw(window)
```

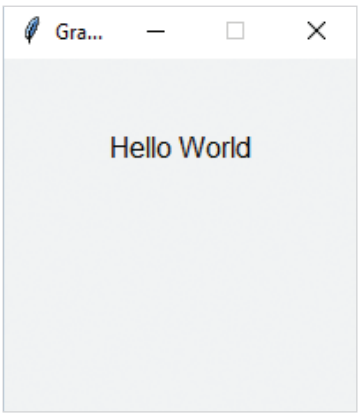

Fig. 8.20 Output of Example 10

The setFill() Function

- It is used to fill a colour inside a shape.
- It takes the name of the colour as its parameter.

  Syntax: setFill("colourname")

Example 11: To draw an ellipse and fill it with red colour

```
from graphics import*
window=GraphWin()
AnOval=Oval(Point(50, 100), Point(150, 160))
AnOval.setFill("red")
AnOval.draw(window)
```

Fig. 8.21 Output of Example 11

Ms Arora tells the class that it is also possible to change the outline colour of a shape and the setOutline("colourname") function is used to do this. She writes the program given in Example 11 again and changes the outline colour to yellow.

```
from graphics import*
window=GraphWin()
AnOval=Oval(Point(50, 100), Point(150, 160))
AnOval.setFill("red")
AnOval.setOutline("yellow")
AnOval.draw(window)
```

Fig. 8.22 Output of the given program

Key Terms

Loop	To repeat instructions again and again
Pixel	A small square that is the smallest portion of an image displayed on a computer screen

Recap

- The input() function is used to take input from users.
- The looping statements are used to repeat commands again and again.
- The 'for' loop is used to iterate over a sequence of items in a list.
- The 'while' loop executes a block of statements till the specified condition remains true.
- The break statement is used to get out of a loop forcefully.
- The continue statement is used to take the control to the top of a loop and ignore the remaining statements in the loop.
- The GraphWin() method is used to create a blank graphics window in Python.
- Any point in the Cartesian plane can be drawn using the Point() method.
- The draw() method is used to draw a desired shape.
- You can draw various shapes, such as rectangles, circles, ovals, and polygons, using the different functions available.
- Python also gives you the ability to add colours and text to the shapes drawn.

Exercise

A. Choose the correct options.

1. Which of the following statements is used to exit a loop forcefully?

   a) for b) continue c) break d) pass

2. Which of the following methods is used to create a blank window in Python?

   a) CreateWin() b) GraphWin() c) Window() d) win()

3. Which of the following loops executes till the condition remains true?

   a) for b) while c) continue d) pass

4. Which of the following methods is used to create a point in graphics window?

   a) Point() b) Pt() c) CreatePoint() d) DrawPt()

5. Which method is used to draw a rectangle?

   a) Rect() b) DrawRect() c) Rectangle() d) DrawRectangle()

6. Which of the following is the correct syntax of the Circle() function?

   a) Circle(20, 30) b) Cirlce(Point(20, 30)

   c) Circle(Point(20, 30), Point(20)) d) Circle(Point(20, 30), 50)

B. State *true* or *false*.

1. The 'for' loop is used to iterate over a sequence of items.
2. The continue statement ignores the conditional statement unless it triggers a break statement.
3. The enter() function is used to take an input from a user.
4. The Polygon() function can be used to create a polygon.
5. The default outline colour of a shape drawn is white.

C. Fill in the blanks.

1. The _____ statement takes the program control to the beginning of the loop statements.
2. The _____ function is used to specify the lower and upper limits to display a list of items.
3. The _____ statement is used to get out of a loop forcefully.
4. The _____ function is used to fill colour in a shape.
5. The _____ function is used to change the width of the outline.

D. Answer the following questions.

1. Discuss 'for' and 'while' loops in python. Give suitable examples.
2. Explain the difference between 'for' and 'while' statements with examples.
3. Write a short program to draw a point P(6, 9).
4. What is the difference between setFill() and setOutline() functions?
5. How can you draw a polygon in Python?

Application-based Questions

1. What will be the output of the program given below?
```
n=20
while n>=0
print (n)
n=n-3
```
2. Open a new graphics window in Python. Write a program to draw a circle inside a rectangle. Fill the rectangle with the green colour and circle with the red colour.
3. Samara has drawn an ellipse in Python. She wants to change the thickness and colour of the outline. How can she do that? Write the program.
4. Write a program to display the Fibonacci series up to 100. Use as few variables as possible. Fibonacci series is a series in which each number is the sum of the previous two numbers:
   1 1 2 3 5 8 13 21 …

Lab Activity

1. Write a program to find the cubes of the whole numbers from 1 to 10.
2. Write a program to print the sum of the first ten natural numbers using the 'while' loop.
3. Write a program to print numbers from 1 to 50 except the multiples of 6.
4. Write a program to draw a triangle with outlines in red.
5. Try the following program in Python and see the output:

```
from graphics import*
window=GraphWin()
line1=Line(Point(10, 100), Point(100, 100))
line1.setWidth(10)
line1.draw(window)
line2=Line(Point(10, 150), Point(100, 150))
line2.setWidth(10)
line2.draw(window)
```

Project

Write a program to draw any three different shapes in Python. Fill each shape with different colour. Also write the name of each shape below it.

Explore More

Explore the ways to clear the graphics window.

Weblinks

- https://www.tutorialspoint.com/python/index.htm
- https://www.programiz.com/python-programming

Notes for the Teacher

- Explain the need for the looping statements by giving some real-life examples.
- Discuss various examples to make students understand the concept of loops in programming.
- Demonstrate how to draw shapes and figures in Python.

9 Internet Services

After going through this chapter, you will be able to—

- **become familiar with** social networking sites;
- **explain** how Facebook, Twitter, and YouTube came into being; and
- **show** internet etiquette.

In the previous class, Manas learnt about the history of the internet and the WWW along with e-learning, e-commerce, and e-banking. His computer teacher told the class how the WWW has revolutionized the way we do various thing in our lives. She also emphasized on how internet services should be used responsibly.

Manas often finds his elders using the words such as 'Facebook', 'blogs', and 'YouTube' at home. He has observed his mother using Facebook to connect with her family and friends. She often puts short pieces of writing on the internet. She tells Manas that these are all social networking sites. While Manas is getting aware of all these things on the internet, his mother decides to guide him through social networking sites.

Social Networking Sites

Manas' mother starts by explaining that a social networking site is an online platform that allows users to connect with other users and share their ideas and interests.

'It helps us find useful information,' she tells Manas.

She explains further, 'It is a web-based service where users have to set up their accounts and create digital profiles. They can then select and follow other members as their contacts. Facebook, Twitter, and Google+ are a few common social networking websites.'

She also mentions that some social networking sites, such as Socialcast, LinkedIn, and Yammer, also provide platforms for business interactions.

Remember

- SixDegrees.com is known to be the earliest social networking site, which existed from 1997 to 2001.
- Friendster and MySpace launched in 2002 and 2003 came later.
- Facebook, launched in 2004, is now one of the most popular social networking sites.

Facebook

Manas' mother tells him that Facebook, a popular social networking site, was founded by Mark Zuckerberg, Dustin Moskovitz, and Chris Hughes at the Harvard University.

'It was launched to help Harvard students connect with each other,' she tells him.

Fig. 9.1 Registering on Facebook

Blog

Manas has learnt from his mother that a **blog** is a website where we can write regularly about our activities and favourite topics.

'People can read your post and comment on it. You can also update your blog regularly and add images and links to other blogs to it,' she tells Manas.

'So you write on a blog,' Manas tells his mother.

'Yes, writing and maintaining a blog is called blogging,' she replies.

Did You Know?

Blog is a short form of 'weblog', which means an online diary.

Microblogging

'What is Twitter?' Manas asks his mother.

'This is a microblogging site,' she replies.

She further explains that **microblogging** is a way of communicating with others on a social networking site by sending short posts typically focusing on one particular point, idea, or emotion.

These posts can contain text, audio, and video. Twitter, Tumblr, Plurk, and Jaiku are some microblogging sites.

Remember

The message sent by you to other users on a social networking site is called a **post**.

Twitter

Manas wants to know how Twitter works. His mother tells him that Twitter allows users to communicate through short messages, called **tweets**.

'Twitter was founded by Jack Dorsey, Evan Williams, and Biz Stone in 2006,' she informs Manas.

Manas now learns that hashtags, words, or phrases with the symbol # before a message are used to search for messages on the same subject on Twitter.

Did You Know?

The founders of Twitter first thought of naming the site 'twitch', but they did not like it. They then searched the dictionary for a suitable word and came across 'twitter', which means a short high sound made by a small bird.

Fig. 9.2 Twitter homepage

Manas' mother now gives him a short account of chat room and instant messaging.

Chat Room

A chat room is a service on the internet that allows users to exchange text messages in real time. In a chat room, people usually share their thoughts on a particular topic. ICQ.com, dolphin.com, and paltalk.com are some websites offering chat-room services.

Instant Messaging

Instant messaging (IM) service is an exchange of text messages via the internet in real time between two users. Facebook Messenger, Snapchat, and WhatsApp are some popular instant messaging services.

Manas' mother tells him that we should use these services to share our ideas on a particular topic. We should also respect others' viewpoints and benefit from them. We can learn a lot about the culture and traditions of the people living in other places using these services.

Checkpoint

Answer the following questions.

1. What is the significance of hashtag?
2. What do you mean by 'microblogging'?
3. Name two social networking sites that offer platforms for business interaction.
4. What is instant messaging?

YouTube

YouTube is an online video site that allows you to view, share, and upload videos. Manas learns that it was founded by Steve Chen, Chad Hurley, and Jawed Karim in 2005, but in 2006, it was purchased by the search engine company Google Inc.

Fig. 9.3 YouTube homepage

Google Maps

Manas has observed his elders using a navigation map to go to a place in a car. He learns from his mother that this is Google Maps, which is a free web-based service that allows us to get to the locations of different places across the world. Map applications like Google Maps display a digital version of a map and can also tell us how to get from one place to another.

'We can reach a destination by just following the Google Maps instructions step by step,' he remembers his uncle once telling him.

'Besides helping us reach a place, Google Maps also help us in detecting our current location, viewing the traffic conditions on the way to our destination, and viewing the estimated time to reach the destination,' his mother tells him.

Fig. 9.4 Google Maps application icon

Internet TV

Internet TV, also called web television, is a service that delivers television content over the internet. It offers video-on-demand supply of TV shows along with live-streaming of TV shows. Some popular internet TV service providers are Netflix, Amazon Prime, Hulu, Hotstar, and Sony LIV.

Internet Radio

Internet radio, also known as online radio, is a service that offers radio content over the internet. It lets us get the live-streaming of radio shows as well as on-demand service of audio clips.

Cloud Storage

Manas' mother now decides to explain cloud storage to him.

She explains that the term 'cloud storage' refers to storing, maintaining, and managing data on remote servers. These remote servers are also known as clouds. The cloud infrastructure is maintained by the cloud service provider. However, the cloud customer pays for the cloud services to the cloud provider.

The service is available to the users through the internet. The users can access their data from any location via the internet. Some of the commonly used cloud services are Apple's iCloud, Amazon AWS, and Google Cloud.

'We can now create and store documents on the internet,' Manas' mother informs him.

Manas is quite curious to know how it is done. His mother explains to him:

'We can simply log on to a web-based service, such as Google Drive. There we can create any document, such as a Word doc, spreadsheet, and presentation. With such a facility in cloud storage, we now don't have to create documents using desktop computer software, such as Microsoft Word and Open Office.'

Did You Know?

Amazon launched its first cloud service in 2006, which was called EC2 (Elastic Compute Cloud).

Google Drive

Manas has now understood how important cloud storage has become in today's world. His mother tells him that Google Drive is one of the most widely used cloud storage services available. He has seen his mother uploading files to Google Drive.

She tells Manas:

'Google Drive allows us to store files on a cloud free of cost up to the capacity of 15 GB. These include all kinds of files, such as audio and video files, photos, documents, presentations, and PDF. We can also create, edit, and share a file on Google Drive.'

Fig. 9.5 Google Drive application icon

Uploading Files on Google Drive

Quick Learn

You can also upload a file on Google Drive by selecting the desired file from your computer and dragging and dropping it on Google Drive.

'How can we upload a file on Google Drive?' Manas asks his mother. She tells him that we need a Gmail account to access Google Drive. She then shows him the required steps:

1. She signs in to her Gmail account.
2. She then clicks on the **Google apps** launch button, and selects the **Drive** icon.
3. After going to **My Drive**, she chooses the **Upload files** option. She tells Manas that alternatively, we can also click on the **New** button and select the **File Upload** option.

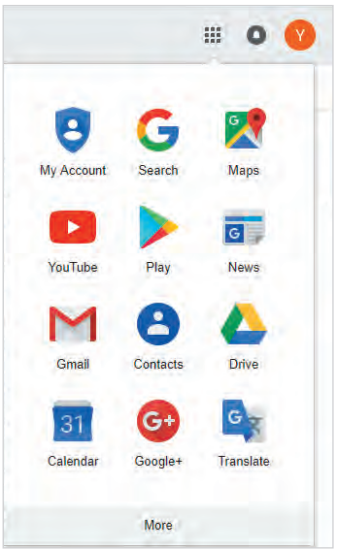

Fig. 9.6 Starting Google Drive

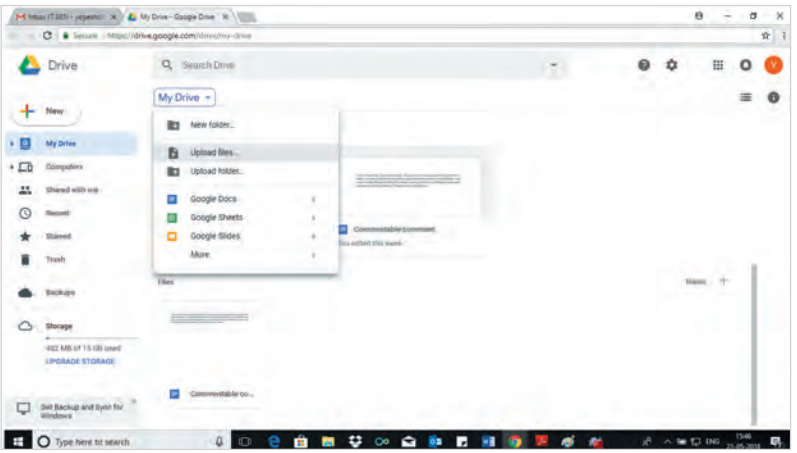

Fig. 9.7 Choosing the Upload files option

4. A dialogue box opens. She selects the file that she wants to upload to Google Drive.

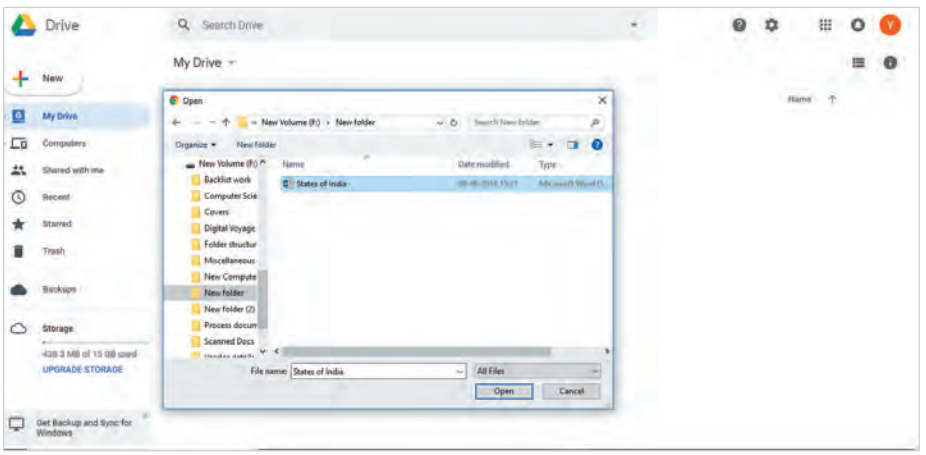

Fig. 9.8 Selecting and uploading a file

5. A pop-up window notifies her about whether the file has been uploaded. Manas can see the uploaded file on the Google Drive folder.

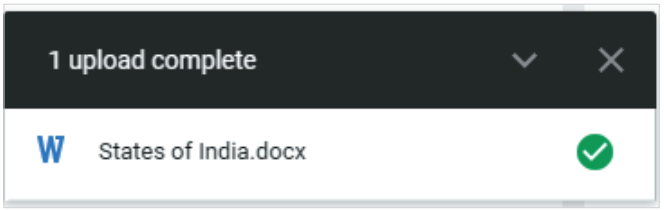

Fig. 9.9 Pop-up window

Fig. 9.10 A file uploaded to Google Drive

Checkpoint

Answer the following questions.

1. What are internet TV and internet radio?
2. List three uses of Google Maps.
3. Define ‘cloud storage’.
4. Who founded YouTube and when?

Internet Etiquette

Manas’ mother reiterates to him that while working on the internet, we need to follow a code of conduct, which is referred to as **netiquette**.

She elaborates some netiquette and emphasizes the need for each while using the internet. She starts with the netiquette followed while using social sites.

Using Social Sites

- Do not post any illegal or inappropriate messages online. Also beware of false messages that spread through social media platforms. Spreading false messages pose a risk to our society. Always ask your elders to check the authenticity of such a message before believing on it, forwarding it, or responding to it.
- Do not share your photos or personal details on any social site as there are people who might misuse them. There are some tools like Privacy Settings that enable us to share our photos with only the people we confide on.

- Do not post negative comments about someone and avoid personal insults.
- If you are forwarding or reposting a message, avoid changing the meaning or essence of the original message.

Writing an Email

- While writing an email, always make sure you are sending it to the right recipients. Sometimes, you might send it to a wrong address.
- Avoid writing email in upper case. It signifies that you are shouting and being rude to the other person.
- An email should always be sent with a subject in the message.
- Including a signature at the end of a message makes it more authentic and personal.
- Avoid including your email signature again and again in the same email conversation to avoid clutter.
- Try to be pleasant when you begin a formal email. Always start with pleasant words like 'Dear …', 'Hi', 'Hello', and make sure you end on a polite note. Be polite yet brief with your courtesy.
- Try not to use BCC (blind carbon copy) too often. The BCC is supposed to be used as a confidential email.
- Be careful while using the Reply All option. Sometimes, we need to send replies to only the sender and not to everyone marked in the email. Sending the reply to everyone may be irritating for recipients in the mail chain. Use the Reply option in such cases. On the other hand, never omit anyone from the group if you are using the Reply All option.
- We should not send false rumours or unsolicited emails. Also, forwarding emails without finding out if the recipient is receptive to them is unethical.

Key Terms

Blog	A website where you can write regularly about your activities and favourite topics
Microblogging	Communicating with others on a social networking site by sending short posts
Chat room	A service on the internet that allows users to exchange text messages in real time
Instant messaging (IM)	An exchange of text messages on the internet in real time between known users
Google Maps	A free web-based service that allows us to get information of different places across the world
Internet TV	A service that delivers the television content on the internet

Internet radio	A service that offers the radio content on the internet
Cloud storage	A service infrastructure that allows to store, maintain, and manage data online
Netiquette	A code of conduct that needs to be followed while working on the internet

Recap

- Social networking means developing social relations over the internet using certain sites or platforms.
- Facebook is one of the largest social networking sites in the world.
- A blog is a website where you can write regularly about your activities and favourite topics.
- Microblogging is a way of communicating with others on a social networking site by sending short posts.
- A chat room is a service on the internet that allows users to exchange text messages in real time. In a chat room, people usually share their thoughts on a particular topic.
- Instant messaging (IM) is an exchange of text messages on the internet in real time between known users.
- Google Maps is a free web-based service that allows us to get information of different places across the world. Nowadays, you can reach a destination by just following the Google Maps instructions step by step. It also offers satellite images, street maps, and panoramic view of places.
- Internet TV, also called web television, is a service that delivers the television content via the internet.
- Internet radio, also known as online radio service, offers the radio content via the internet.
- Cloud storage means taking backup of data online.
- While working on the internet, we need to follow a code of conduct that is referred to as netiquette.

Exercise

A. Choose the correct options.

1. Which of the following is a social networking site?
   a) Facebook b) Orkut c) Twitter d) All of these
2. Which of the following is an instant messaging platform?
   a) Facebook b) WhatsApp c) Twitter d) All of these
3. Which symbol is used to search the messages related to a particular topic on Twitter?
   a) # b) ? c) / d) !
4. Which of the following is a cloud computer service?
   a) Google Drive b) Netflix c) Yammer d) None of these
5. Which of the following is not a microblogging site?
   a) Twitter b) Tumblr c) Jaiku d) Socialcast

B. State *true* or *false*.

1. Twitter was founded by Jack Dorsey, Evan Williams, and Biz Stone in 2006.
2. Facebook was founded by Evan Willaims.
3. A blog is a type of social networking site.
4. A post is a message that is sent by us to other users on a social networking site.
5. Jack Dorsey is one of the founders of Twitter.
6. YouTube was founded in the year 2004.
7. We can reach to any place by using the Google Maps.

C. Fill in the blanks.

1. We can log in to Facebook using our _____ and _____.
2. 'Blog' is a short form of _____.
3. The messages that are sent and received on Twitter are called _____.
4. In 2006, YouTube was purchased by _____.
5. Internet TV is also known as _____.
6. An email should never be sent without a _____.
7. The code of conduct that is followed while working on the internet is called _____.

D. Answer the following questions.

1. Define social networking. Give three examples of social networking sites.
2. Discuss the dangers prevalent in social networking.
3. Explain internet TV and internet radio.
4. Write a short note on YouTube.
5. What is cloud storage?
6. What are netiquette ? Write any five netiquette.

Application-based Questions

1. Akanksha writes poems and short stories. She wants to post them on the internet. But she wants to share her writings with her friends and family and does not want to post these on any social networking site. Suggest the ways in which Akanksha can do that.
2. Discuss the dangers and impact of false news in the world today.

Lab Activity

Open Google Drive and try storing and retrieving documents from there.

a) Log on to the Google Drive and create a Word document on the process of photosynthesis. Save the document to the Google Drive. Give it a name. What name did you give it?
b) Now make a presentation on the human digestive system and upload it on the Google Drive.
c) Did you use the software saved on your computer or from the internet to create the above documents?
d) Who has provided the software for creating these documents?
e) Have you stored the documents on your machine or the internet?

Project

1. Create a presentation in Google Drive, of about 15 slides, on acids and bases. List their properties and uses. Then share the presentation with your teacher.
2. Create a spreadsheet listing your food intake for a week and the calories each foodstuff gives in MS Excel. Save this spreadsheet on any cloud like iCloud or Dropbox. Then retrieve the file and try opening it too.

Explore More

Observe the figure given alongside. What does it signify? What is encryption? Gather information about WhatsApp encryption and find out how it is helpful to us. Also, how could this be misused?

Weblinks

- https://anh.cs.luc.edu/python/hands-on/3.1/handsonHtml/graphics.html
- https://www.tutorialspoint.com/python/index.htm
- https://www.programiz.com/python-programming

Work Wisely

Avoid logging in to your email account from an unknown computer. Your account might get hacked.

Notes for the Teacher

- Emphasize the importance of netiquette.
- Highlight the things that we should take care of while using a social networking site.
- Elaborate on how cloud storage has facilitated our work, especially in the business world.

10 Synfig Studio

After going through this chapter, you will be able to—

- **outline** the different components of the Synfig window;
- **classify** the different tools of Synfig and define their functions;
- **make** animations using Synfig; and
- **create** and **save** files in Synfig Studio.

Bidisha is fond of watching animated films. She has recently watched *The Ice Age*, *Frozen*, and *Tintin*. She has always wondered how such films are made. She asks her computer teacher, Ms Aradhna Gupta.

She tells her that a lot of effort goes behind making these films and animation plays the most important role here.

'What is an animation?' Bidisha asks.

'It is a process of displaying a sequence of images one after the other that creates an illusion of movement,' Ms Gupta tells her.

Bidisha learns that earlier 2D animations were created by drawing images on plastic films. It used to be a tedious task, where films were shown one after the other in fast and quick manner. With the invention of computers and animation software, it became time-efficient and much easier.

Ms Gupta tells her that Synfig Studio, Pencil, and Adobe Animate CC are a few examples of 2D animation software.

In next class, Ms Gupta decides to deal with Synfig.

Did You Know?

An animation is based on the phenomenon of persistence of vision.

Introduction to Synfig Studio

Ms Gupta tells the class that Synfig Studio is an open-source 2D animation computer software.

'It primarily works on 2D images and helps in creating basic graphics and animation effects. You can download it from http://www.synfig.org,' she tells the class.

Starting Synfig Studio

After getting the Synfig Studio installed on the computer, Ms Gupta now starts Synfig:

- She clicks on the **Start** button.
- She then clicks on the **Synfig** folder and selects the **Synfig Studio** option.

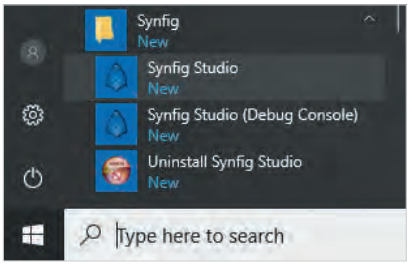

Fig. 10.1 Starting Synfig Studio

Components of a Synfig Studio Window

The Synfig Studio window opens. Ms Gupta now shows the components of the Synfig Studio Window to the class and explains these to them.

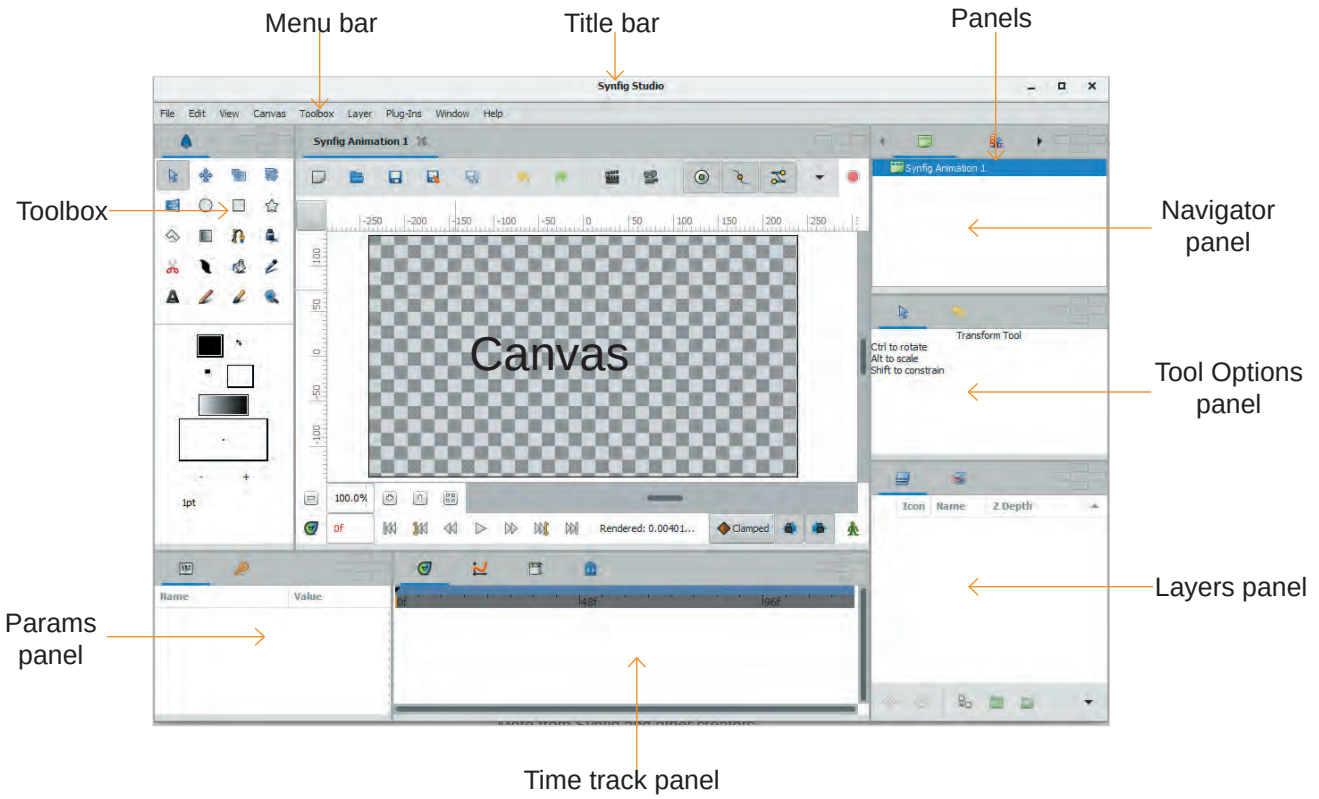

Fig. 10.2 Synfig Studio window

Title Bar

- It is located at the top of the window.
- To its right, the minimize, maximize, and close buttons are located.

Remember

You can also select the tools from the Toolbox tab on the menu bar.

Menu Bar

- It is located below the title bar.
- It has nine tabs, which contain various commands for performing different operations.

Toolbox

- It is located on the left side of the Synfig Studio window.
- It contains various tools to create graphics and animations.

The toolbox window is further divided into two areas—upper and lower.

- The upper area contains all the tools, such as select, circle, rectangle, and scale, for creating and editing graphics and animations.
- The lower area contains some default settings, such as foreground and background colour, default gradient, and brush preview settings.

Fig. 10.3 Toolbox

Canvas

- It is the main window located at the centre of the Synfig window.
- It is where our work and art is displayed.

Panels

- These are present on the right and bottom of the window.
- These contain tools and information about various elements of a project.

Ms Gupta now shows to the class different panels available in Synfig.

Navigator panel

The Navigator panel helps to move around the canvas window by zooming in and out. It has a Navigator button that shows a slider that helps to zoom in and out of an image. It also provides you the information regarding position (*x*- and *y*-coordinates) of the cursor on the image. It also lets you change the default background colour settings.

Tool options panel

The Tool Options panel gives you extra options to modify the settings of the tool. For example, you can set the opacity of the Brush tool or use a tool of different thickness. You can also set the size of the tool using this panel.

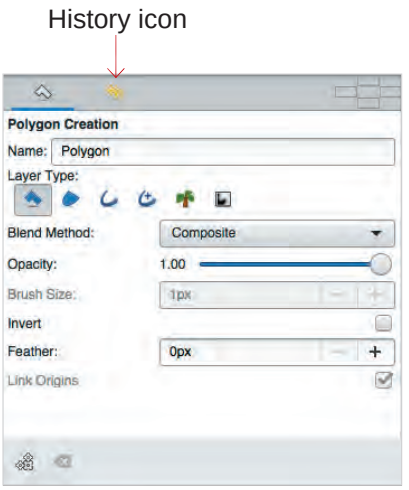

Fig. 10.4 Tool options

History panel

The History panel keeps track of all the changes made while editing a file. To open the History panel, click on the History icon.

Layers panel

Ms Gupta tells the class that an image is made up of various components and these components are called layers.

'Imagine several photos stacked on top of each other. Then think of these photos together making up a single image. These several photos are layers,' she explains.

Now she introduces the class to the layers panel. It provides you the details about the layers you are working on. It also lets you edit and manipulate these layers.

Params panel

The Params panel shows information about the active set of parameters, such as the width, size, and opacity of the tool.

Time track panel

The time track panel shows a Timebar that helps you to control the timings of graphics and animations you create. A Timebar provides you the information on the keyframes and duration of the project.

Keyframes

Animations are created using frames. A frame refers to an individual image in a sequence of images. These individual images, or frames, are displayed one after another to create an animation. The number of frames displayed per second is called FPS, and this number can be defined when you create an animation.

Remember

The frame rate shows the number of frames per second.

A keyframe indicates a mark in the timeline which shows that some change has occurred in the frame. In animation, as in video, keyframes are used to mark the beginning and end of a specific animation sequence. For example, the initial keyframe may set a light bulb to glow very dimly, and the end keyframe may set it to glow brightly. The animation software can help to brighten the bulb gradually in each frame between the keyframes, thus creating a smooth animation. A keyframe is represented by a light brown vertical dashed line in the time track panel.

Using the Tools

Ms Gupta tells the class that there are many tools available in Synfig.

'When a tool is selected, its parameters are shown in the Parameter panel and its associated options are displayed in the Options panel,' she tells the class.

Using Circle Tool (Alt + C)

Bidisha wants to know about using the Circle tool.

Ms Gupta tells the class that the Circle tool, when used, creates a new circle layer. She selects the Circle tool from the toolbox and then drags the mouse over the canvas area.

Did You Know?

The handles are also known as ducks in Synfig.

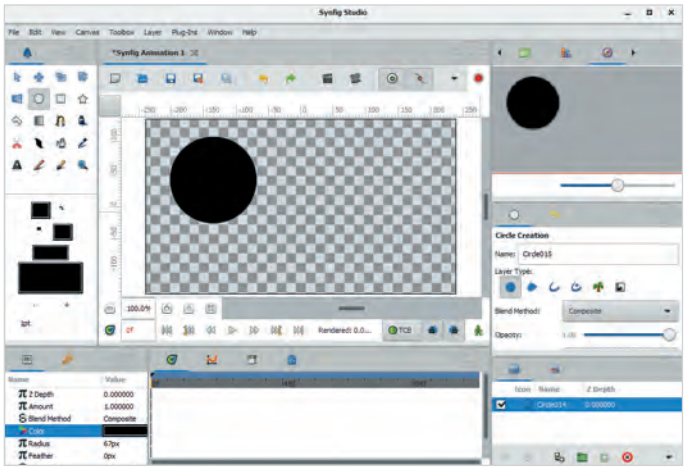

Fig. 10.5 Drawing a circle

Remember

Handles help to resize, rotate, and move the objects on the canvas. Every object has different handles.

'How can we change the position and radius of the circle?' Leena asks Ms Gupta. She tells Leena that, for that we have to first select the Transform tool. She selects the Transform tool. Two coloured points, blue and green, appear on the circle.

'These points are known as handles. These are used to control the parameters of a layer,' she tells the class.

She increases and decreases the radius of the circle by clicking on and dragging the blue handle. She then clicks on and drags the green handle and places it at the desired position to change the position of the circle.

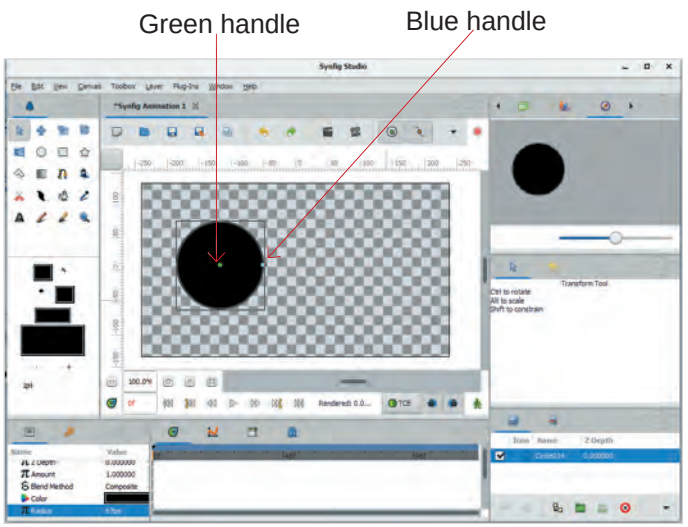

Fig. 10.6 Circle handles

Ms Gupta tells the class that by default, the name of the circle layer is **Circle001** in the Layers panel, but it can be changed by clicking on its name box.

The class practises using the Rectangle tool in the same way as the Circle tool. They notice that this tool also has two handles. While using the Polygon tool, Ms Gupta tells

Quick Tip

To limit the movement of the handles either horizontally or vertically, press and hold the Shift key while dragging.

Quick Learn

1. Create a rectangle, star, and circle on the canvas. Add the names of these shapes inside them.
2. Create a candle using the Spline tool.

the class that a Polygon can be drawn using any number of points and they need to click on the first point to close the polygon.

Ms Gupta also gives a glimpse of some more tools in Synfig.

Name	Keyboard Shortcut	Icon	Use
Spline tool	Alt + B		To draw objects with any number of points and curves
Gradient tool	Alt + G		To mix two or more colours
Text tool	Alt + X		To add text by creating a text layer
Draw tool	Alt + D		For freehand drawing using the mouse (works just like the pencil tool)
Fill tool	Alt + F		To fill colours in shapes
Eyedrop tool	Alt + E		To copy a colour from an object and set it as the default foreground colour
Zoom tool	Alt + Z		To get a closer look of an object in the canvas area
Mirror tool	Alt + M		To mirror the handles either in the horizontal axis or vertical axis
Cut-out tool			To select a portion of a drawing by adding a mask
Sketch tool	Alt + K		To sketch a freehand drawing on the canvas
Brush tool			To paint the areas using the desired colour (can also be used as an eraser)
Width tool	Alt + W		To increase or decrease the thickness of a line
Smooth Move tool	Alt + V		To move, scale, or rotate multiple objects and the handles
Scale tool	Alt + S		To scale multiple objects and the handles
Rotate tool	Alt + T		To rotate multiple objects and the handles about the centre of the selected group

Checkpoint

Find out if the functions of the tools listed below are correct. If not, correct their functions.

Function	Description
	It is used to draw shapes.
	It is used to mix two colours.
	It is used to draw a rectangle.
	It is used to type text.
	It is used to mix two colours over an area.

Creating a New File

Ms Gupta now creates a new file:

1. She selects the **File** menu > **New** option. A new canvas window opens.
2. She then selects the **Canvas** menu > **Properties** option. The **Properties** dialogue box appears. The properties of the canvas can be changed here.

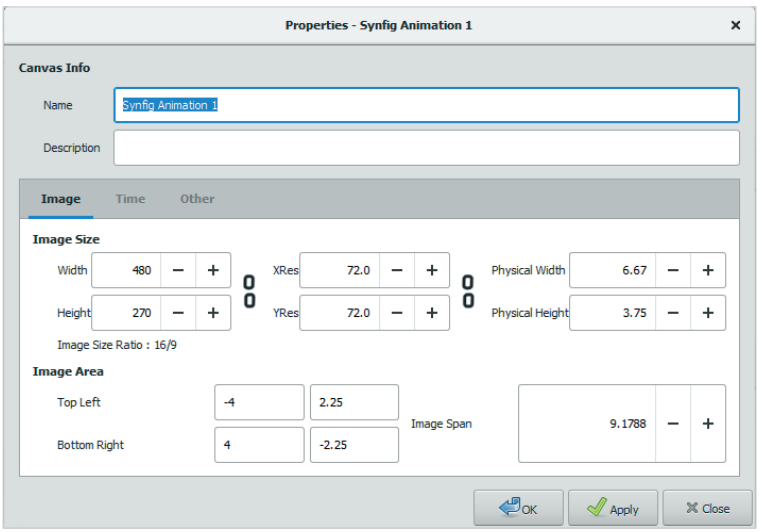

Fig. 10.7 Properties dialogue box

3. In the **Name** box, she enters a name for the file and adds a description in the **Description** box.
4. The class notices that there are three tabs in the window—**Image**, **Time,** and **Other**. Ms Gupta tells the class:
   a) The **Image** tab is used to adjust the width and height of the image.
   b) The **Time** tab is used to adjust the start time, end time, and frames per second.
5. She then clicks on **OK** to apply the changes that she has made.

'We can now start working on our canvas,' she tells the class.

Creating a Simple Animation

'Let us start with creating a simple animation by moving a star back and forth,' she tells the class and follows these steps.

1. Ms Gupta selects the Star tool in the toolbox and drags the mouse pointer over the canvas to draw the star layer.

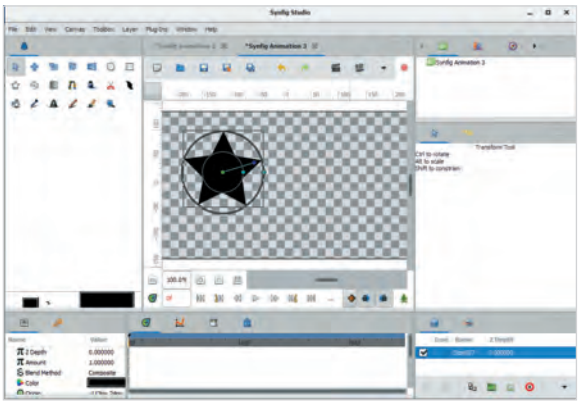

Fig. 10.8 Drawing a star

Quick Tip

The brush tool can be used as an eraser tool. When you select the brush tool, the options panel displays the eraser option.

2. She then selects the Transform tool and make some changes.
3. In the Parameter panel, she double-clicks the **Color** bar. The **Colors** box appears. There she chooses the red colour and clicks on **Close**.

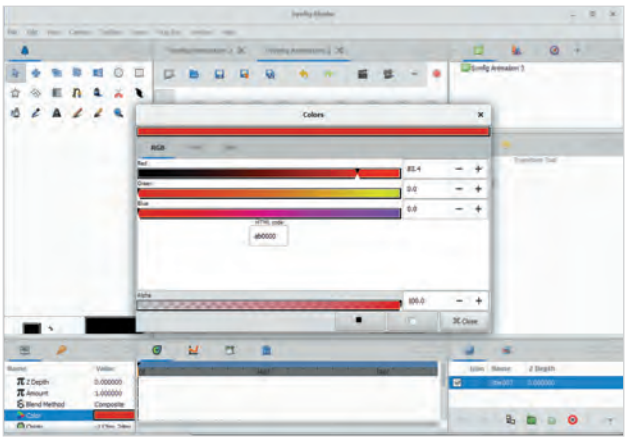

Fig. 10.9 Modifying the colour of the star

4. Now she clicks on the **Turn on Animate Editing Mode** button. Bidisha notices that the canvas is outlined with a thin red border.

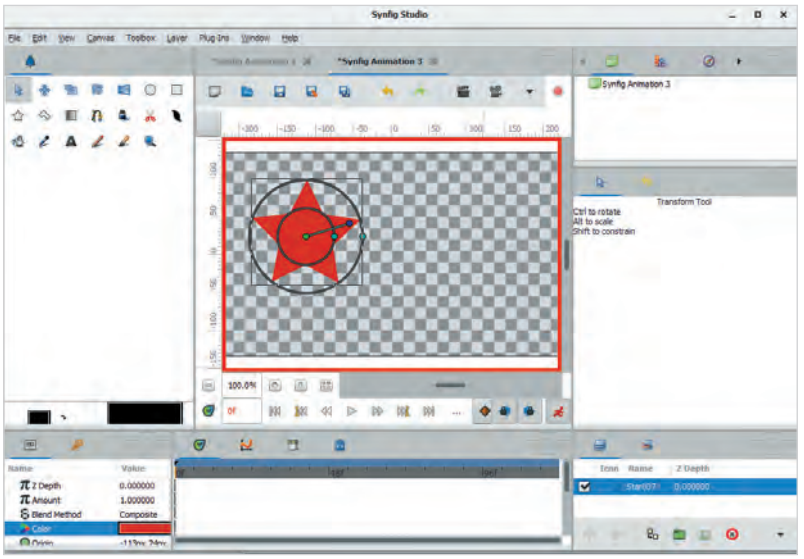

Fig. 10.10 Turning on the Animation

5. Again she goes to the Parameter panel and clicks on button to open the Keyframe panel. She clicks on the icon at the bottom of the Parameter panel. A new keyframe is added to the '0f' mark.

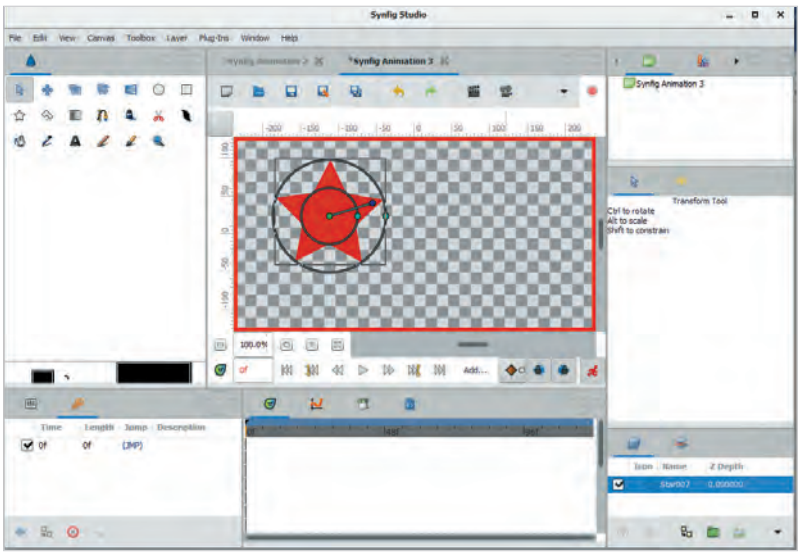

Fig. 10.11 Adding a keyframe to the '0f' mark

6. Now she clicks on the '12f' mark and adds a new keyframe (by clicking on the Plus icon). Then she moves the position of the star to the right as shown in Fig. 10.12.

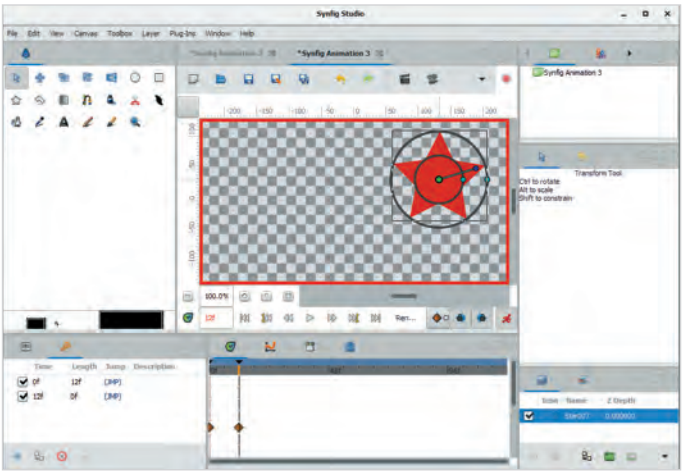

Fig. 10.12 Adding a keyframe at the '12f'

7. She clicks on the '24f' mark and adds a new keyframe. She then drags the star to its original position.

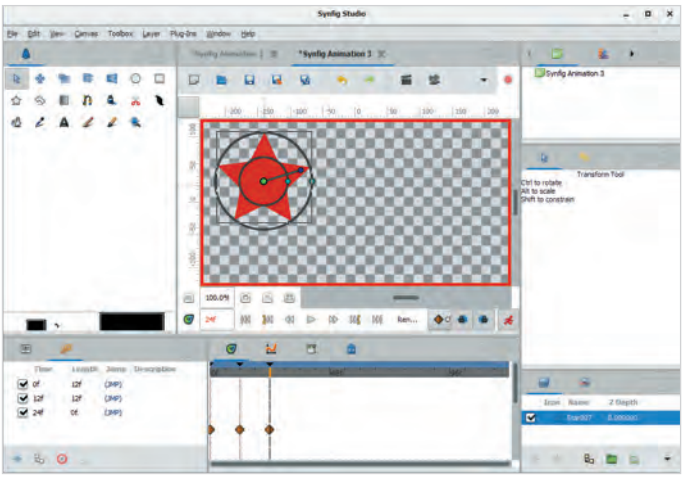

Fig. 10.13 Adding a keyframe to the '24f'

8. Now she clicks on the **Turn off Animate Editing** button and moves the mouse pointer over the canvas. She right-clicks on an empty area and selects the **File > Preview** option.
9. The **Preview Options** dialogue box appears. She checks the End time check box and sets the value of the fps as required—30fps.

   Ms Gupta tells the class that fps (frames per second) is the rate at which our drawing moves—the number of frames displayed per second.

   'It has a great impact on the style and viewing experience of a video or animation. The more fps we use, the smoother our animation looks,' she tells the class. 'However, the higher the number of frames, the bigger the file. So the decision on how many frames per second are to be displayed must be taken based on how the file is going to be distributed and played. For example, for a web-based animation, a lower value of fps is preferable to ensure the file is not too big to download. Higher frame rates are used if the animation is going to be broadcast (for viewing on TV, for example) or played off a DVD. The rate of 25–30 fps is the usual standard for films and TV.'

10. She now clicks on the **Preview** button. The **Preview window** appears.

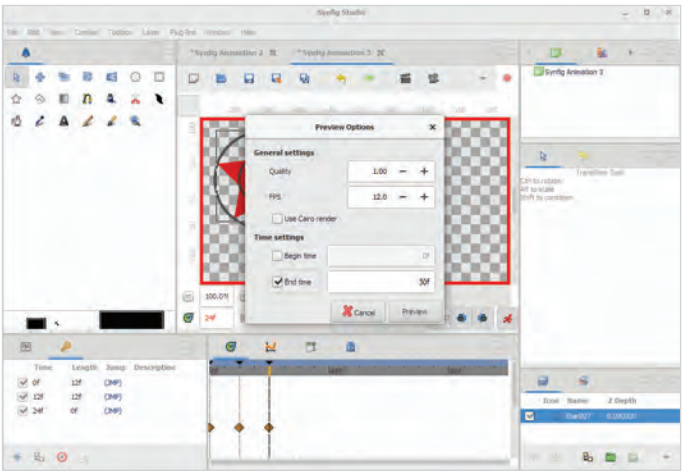

Fig. 10.14 Preview Options dialogue box

11. She clicks on the **Play** button to play the animation.

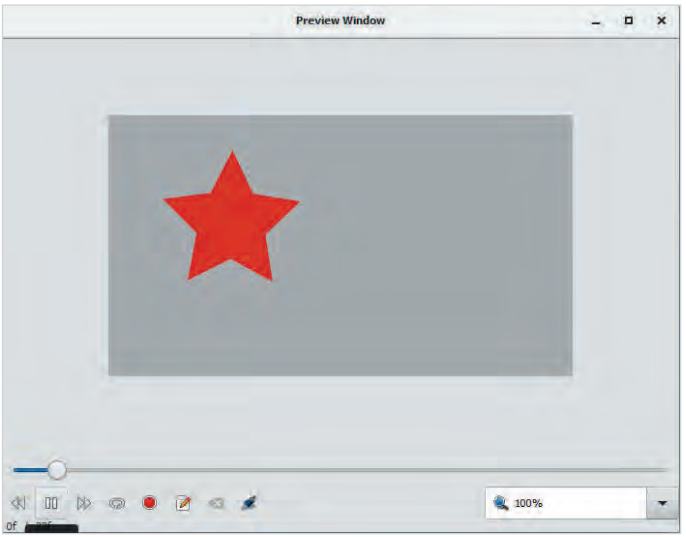

Fig. 10.15 Playing animation

Now the class is ready to create animations in Synfig. Ms Gupta now asks the class to animate a star from left to right with increasing size.

Example 1: Animating a star from left to right with increasing size

1. Open a new canvas window.
2. Select the **Star** tool in the toolbox, and drag the mouse pointer over the canvas to draw the Star layer.
3. Select the Transform tool, and make the changes, if you want.
4. In the Parameter panel, double-click the **Color** bar. The **Colors** box will appear. Choose the desired colour and click on **Close**.
5. Now click on the **Turn on Animate Editing Mode** button. On doing so, the canvas is outlined with a thin red border.

6. Now go to the Parameter panel, and click on button to open the keyframe panel.
7. Click on the icon at the bottom of the Parameter panel. It will add a new keyframe at the '0f' mark.
8. Now click on the '12f' mark, add a new keyframe, and move the position of the star.
9. Increase the size of the star by using the Transform tool by dragging the position handle.
10. Click on the '24f' mark, and add a new keyframe. Drag the star to its original position.
11. Again increase the size of the star by using the Transform tool by dragging the position handle.
12. Click on the **Turn off Animate Editing** button.
13. Move the mouse pointer over the canvas. Right-click on an empty area and select the **File > Preview** option.
14. The bold face dialogue box appears. Check the **End time** check box and modify the value of the fps as per the requirement.
15. Now click on the **Preview** button. The **Preview** window will appear.
16. Click on the **Play** button to play the animation.

Animation Using the Time Loop

Ms Gupta now tells the class that we can repeat our animation by using the time loop.

She asks the class to follow the steps given previously and then follow these steps:

- Right-click the Star layer.
- Click on **New Layer** > **Time** > **Time Loop**.

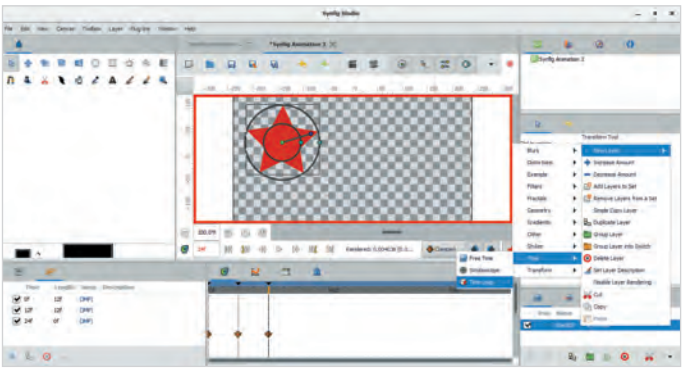

Fig. 10.16 Adding Time Loop layer

- A Time Loop layer will be added to the Layers panel.
- Now move the mouse pointer over the canvas. Right-click on an empty area, and select the **File** > **Preview** option.
- The **Preview Options** dialogue box appears. Check the **End time** check box, and modify the value of the fps as per the requirement. In our example, we will set it to 50fps.
- Now click on the **Preview** button. The **Preview window** will appear.

Quick Learn

Create an animation of a moving a ball from left to right using the time loop. Show its size decreasing as it moves.

- Click on the **Play** button to play the animation.

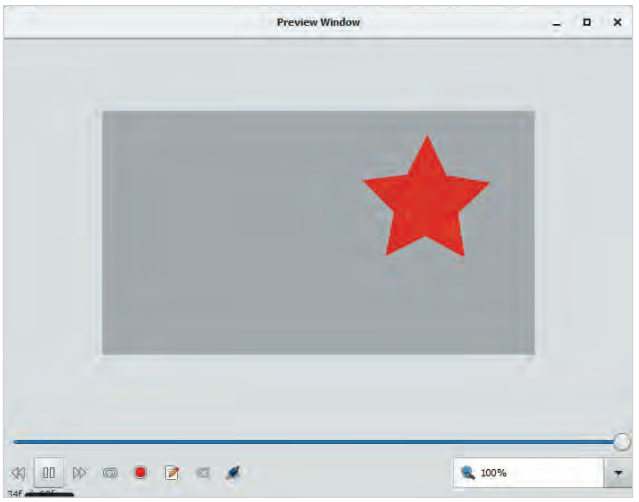

Fig. 10.17 Previewing animation

Saving a File

To save a file in Synfig, Ms Gupta follows these steps:

1. She clicks on the **File > Save As** option.
2. The **Please choose a file name** dialogue box appears. She enters the desired name of the file.

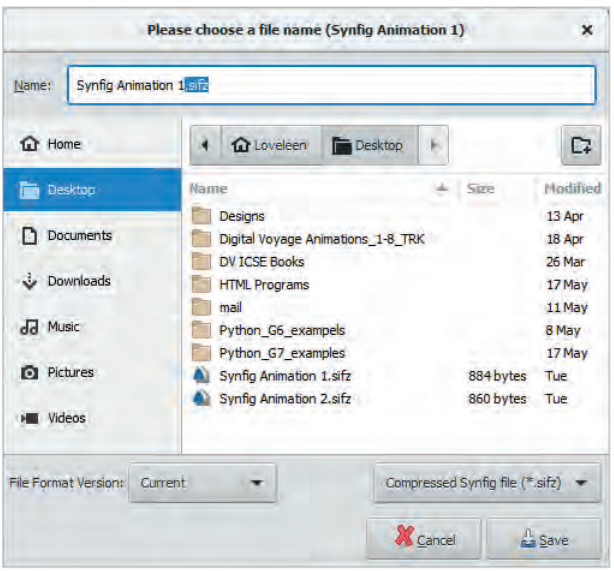

Fig. 10.18 Saving file

She tells the class that by default, Synfig saves the files in a compressed form with a '.sifz' file extension. She emphasizes the need for compressing a file by telling the class that compression reduces the file size and it takes less space in the computer.

'However, if you want to save the file in an uncompressed form, click on the **Compressed Synfig file** down-arrow,' she tells the class.

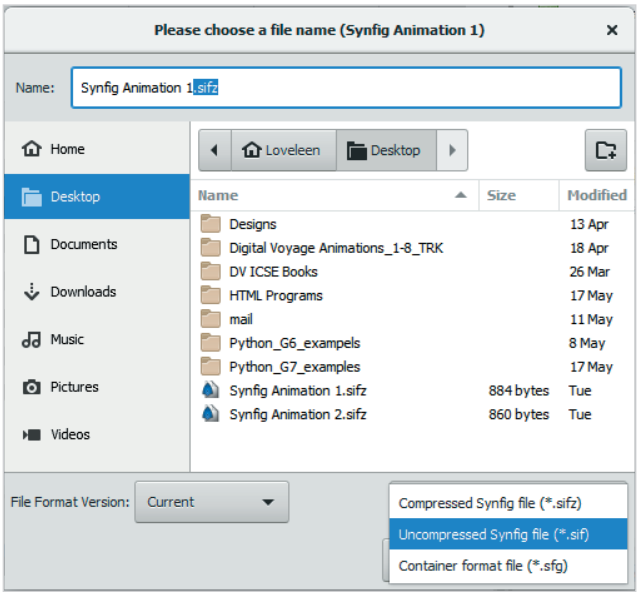

Fig. 10.19 Saving file in uncompressed format

3. She selects the **Uncompressed Synfig file** option. It saves the file with a '.sif' extension.
4. She clicks on the **Save** button.

Key Terms

Animation	An illusion of movement created by a series of images displayed in a quick succession
Frame	A length of time in a document
Keyframe	A frame where a change has occurred

Recap

- Synfig Studio is an open-source 2D computer animation software.
- The Synfig Studio interface has various components.
- A canvas in the Synfig window is the main window where you create and edit your work.
- There are different tools used for drawing and editing shapes and images.
- An animation involves a sequence of still images that are displayed quickly one after another.

Exercise

A. Choose the correct options.

1. Which of the following is a panel in Synfig?
   a) Params b) History c) Layer d) All of these
2. What is the keyboard shortcut to select the Circle tool?
   a) Alt + C b) Ctrl + C c) Shift + C d) Alt + Shift + C
3. Which of the following colour handles is used to change the position of the circle?
   a) Green b) Red c) Blue d) Orange
4. Which of the following tools is used to select objects?
   a) Selection b) Transform c) Rotate d) Circle
5. Which of the following tools allows you to change the colour of an object?
   a) Fill b) Color c) Rectangle d) Draw

B. State *true* or *false*.

1. The file extension of a project created in Synfig Studio is '.syn'.
2. The Params Panel displays the parameters of the currently selected layer.
3. The Spline tool is used to make objects with any number of points and curves.
4. A frame defines the change in an object's properties.
5. The Brush tool can be used as an eraser.

C. Fill in the blanks.

1. The _____ is the window where you see and create your artwork.
2. The _____ tool is used to draw objects.
3. The _____ tool lets you select the colours where you are currently pointing at.
4. The _____ tool is used to create a text layer.
5. The _____ panel keeps records of all the changes made while editing a file.

D. Answer the following questions.

1. What are the components of the Synfig Studio window?
2. Define the term 'keyframe'.
3. What is the purpose of timebar?
4. Write the function of the following tools:
   a) Rotate b) Transform c) Scale d) Mirror
5. Write the steps to draw a polygon.

Application-based Questions

1. Rahul has added some shapes and text to his Synfig file. He wants to change the font face and font size. Help him in completing the task.
2. Neha wants to draw human eyes in Synfig. List the tools she will use.

Lab Activity

1. Draw a cone using the Polygon tool. Fill it with a colour of your choice.
2. Draw a ball of red colour. Create an animation showing the ball bouncing. [Hint: Use the time loop layer]
3. Create an animation showing a ball and a star moving from right to left at the same time.
4. Create an animation and show three yellow balls moving at the same time.

Project

1. Draw a leaf using suitable tools. Animate it by showing it swinging from top to bottom.
2. Create an animation to show the life cycle of a silk moth.
3. Create (or download) a drawing of the human heart. Use it to create an animation to show labels appear one by one describing how the blood enters the heart and leaves it, with arrows pointing to the appropriate portions of the heart.

Explore More

- Find out and list some industries where animation is used.
- Find out what are the different stages involved in creating an animation.

Weblinks

- https://opensource.com/article/16/12/synfig-studio-animation-software-tutorial
- https://www.techsmith.com/blog/frame-rate-beginners-guide/

Notes for the Teacher

- List and explain the components of the Synfig Studio window.
- Explain the use of all the tools and describe their functions.
- Demonstrate how to create animations by taking examples.

Worksheet 1

A. Choose the correct options.

1. Which of the following numbers represents the decimal number system?

   a) 0 to 9 b) 1 to 10 c) 0 to 10 d) 2 to 11

2. Which of the following tags in HTML is used to underline the text?

   a) <u> b) c) <under> d) <uline>

3. Which of the following tools is used to copy pixels from an image or a pattern?

   a) Healing b) Burn c) Clone d) Dodge

4. Which of the following properties is used to render text from right to left?

   a) direction b) text-transform c) text-indent d) font

5. What is the default file extension of an uncompressed Synfig file?

   a) .sifz b) .sif c) .sfg d) .sifc

B. Give any two examples for each of the following.

1. Program virus _____ _____
2. Charts in Excel _____ _____
3. Transform tools in GIMP _____ _____
4. Instant Messaging services _____ _____
5. Microblogging sites _____ _____

C. Fill in the blanks.

1. The _____ virus infects data files.
2. The _____ function is used to create a straight line between two points in Python graphics.
3. The _____ error occurs when a program executes but does not produce the intended result.
4. A mini-chart that can be added in a single cell is called a _____.
5. The _____ tool is used to change the dimensions of the layers or selections in an image in GIMP.

D. Write a program in Python:

1. To print all the even numbers from 10 to 20
2. To print all the multiples of 5 between 20 and 50

Worksheet 2

A. Choose the correct options.

1. Which of the following functions returns the remainder when a number is divided by zero?
   a) SQRT b) POWER c) FLOOR d) MOD
2. Which of the following tools is used to spin an image or a part of it?
   a) Perspective b) Shear c) Rotate d) Move
3. What is the keyboard shortcut to use the Circle tool in Synfig?
   a) Alt + C b) Ctrl + C c) Shift + C d) Alt + Shift + C
4. Which of the following is an antivirus application?
   a) Melissa b) McAfee c) Mafiaboy d) Vundo
5. Which of the following symbols is used for string concatenation?
   a) # b) & c) $ d) ^

B. State *true* or *false*.

1. The enter() function is used to take an input from a user in Python.
2. A Pie chart displays data in the form of a circle that is divided into slices.
3. The =avg() function is used to find the average of a given range of numbers.
4. The while loop iterates a block of statements as long as the given condition is true.
5. Phishing is an act of sending deceptive email.

C. Define the following terms.

1. Keyframe

   _____

   _____

2. Netiquette

   _____

   _____

3. Runtime error

   _____

   _____

4. Container element

_____

_____

5. Virus

_____

_____

D. Convert the following.

1. $(1100101)_2$ = ( )$_{10}$
2. $(26AFB)_{16}$ = ( )$_{10}$
3. $(0011101)_2$ = ( )$_8$
4. $(126)_{16}$ = ( )$_{10}$
5. (0111)–(0001) = ( )$_2$